ENHANCING SUPPLY CHAIN MANAGEMENT THROUGH INFORMATION AND COMMUNICATION TECHNOLOGY BASED INNOVATIVE SOLUTIONS: THE CASE OF AN INTERNATIONAL ELECTRONIC FIRM IN MALAYSIA

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ABSTRACT

This study is set to unravel the link between effective Supply Chain Management (SCM) practices and the overall performance of a selected electronic manufacturing firm in Malaysia. Past research has indicated that the inefficiency of many firms failing in SCM practices may be due to inability in incorporating *technological capabilities* (ICT Based Innovative Software Solutions for Information Sharing and Processing) in their SCM practices. Research evidence indicates that, the incorporation and effective usage of these *technological capabilities* for the benefit of information sharing and processing have turned around many electronics manufacturing firms into profitable organizations. This 'case study like' approach endeavors to explore how the so called *technological capabilities*, in the context of innovative software solutions for information sharing and processing help in the SCM process in electronics contract manufacturing firms. It analyses the relationships between internal and external integration processes of information sharing, their effect on firms' performance and their contribution to the achievement of a competitive advantage. A well-known electronic manufacturing services company with its three different branches in Malaysia has been chosen as the sample for this fascinating study. Qualitative interviews were conducted with 15 senior level managers (5 from each of the three branches) who were involved in the SCM operations in the said firms. The findings focus on the proven success of ICT based innovative Software Solutions for Information Sharing and Processing. Several outstanding application systems such as, EDI, SCMDW, Quote win, ASPECT and SAP have been found to be effective in the advancement of Supply Chain processes. It is suggested that other key players need to adapt to new technologies in the SCM process to stay on as front runners in the industry.

ABSTRAK

Kajian ini bertujuan untuk menilai sejauh mana keberkesanan pengurusan rantaian bekalan bahan mentah (SCM) yang cekap dan effektif dengan prestasi keseluruhan sebuah firma elektronik di Malaysia. Terdapat sejumlah kesusasteraan terdahulu dalam bidang ini mendedahkan bahawa kekurangan kecekapan dalam pengurusan rantaian bekalan bahan mentah adalah disebabkan ketiadaan unsur kebijaksanan teknologi yang diterapkan dalam pengurusan rantai bekalan bahan mentah ini. Bukti daripada kajian terdahulu juga mendedahkan bahawa penerapan pelbagai teknologi membawa keuntungan kepada firma dalam industri pembuatan secara tidak langsung mengurangkan kos operasi. Kajian kes ini berhasrat untuk mengkaji bagaimana penerapan teknologi dapat membantu dalam firma pembuatan barangan elektronik secara kontrak. Ia menganalisa perhubungan di antara intergrasi dalaman dan luaran yang memberi kesan kepada pencapaian serta peranan teknologi ini dalam memberi kebolehan tambahan kepada sesuatu firma. Sebuah firma yang terkenal di kalangan industri pembuatan secara kontrak ini yang mempunyai tiga cawangan telah di pilih sebagai sampel. Temuduga kualitatif telah dijalankan dalam kalangan 15 ahli pengurusan yang senior di mana 5 dari setiap cawangan dipilih dari bahagian pengurusan bekalan. Beberapa aplikasi yang termuka seperti EDI, SCMDW, Quote win, ASPECT and SAP telah terbukti effektif dalam proses pengurusan pembelian bahan mentah. Oleh itu dicadangkan agar pengusaha lain dapat mengadaptasikan dengan teknologi seperti ini untuk terus maju serta kekal di dalam industri ini.

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This project paper was done with much sacrifices and hard work, and stress but along the way there were much fun, rejoicing and reward – plus the joy of working with some wonderful people who care to share.

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Many thanks go to my late mother Achi Paramachi, my wife Nisha Shi, and family members Komathi Rajangam and Vajaya Kumar for their constant prayers, unconditional love, support and encouragement. Certainly if not for them, I would not be what or where I am today!

ABSTRACT

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LIST OF ACRONYMS

Abbreviation	Meaning
AVL	Approved Vendor List-A List of Suppliers approved to Supply for a particular components or materials.
BOM	Bill Of Material- A list of components required to produce a product.
Distributor	A type of company that did not manufacture any components or materials on their own, but has an agreement with the manufacturer to resell the parts.
DSS	Decision Support System. A system developed to assist a group of staff in decision making. With a systematic process and flow that ensures all important factors taken into consideration.
EDI/RSS	Electronic Data Interchange/Repetitive Supplier Scheduling. Forecast sharing by customer to their supplier to plan for and schedule manufacturing efficiently to support them back.
ERP	Enterprise Resource Planning- A system used by buyers to place purchase orders with suppliers. Under this system, the studied company uses SAP And BPCS applications.
ICT	ICT is short for "Information and Communication Technologies." It is similar to IT (Information Technology), but focuses more on telecommunications mediums, such as the Internet, cell phone networks, and satellite technology. Modern forms of ICT have made it possible for users across the world to communicate with each other in real-time on a regular basis.
IT	Information Technology. Information Technology is a computer and networks based technology to store, process, and receive data required for the processing of data and other information replacing physical files and paper documentation.
Manufacturer	An organization that produce any raw materials,

	components or products.
MOQ	Minimum Order Quantity. The minimum numbers of parts that must be ordered via single purchase order.
Supplier	An organization that supplies any raw materials, components or products.
SC	Supply Chain. Supply Chain is a system consists of all parties involved, directly or indirectly via organizations, people, technology, activities, information and resources.
SCM	Supply Chain Management. Supply Chain Management is the integration of key business processes from the end user through the original suppliers who provide products, services, and information. SCM adds value for customers and other stakeholders (Lambert & Cooper, 2000).
TC	Technological Capabilities. Technological Capability is a term used to gain an overview of the technological components on the market to assess their value and select the best suit to achieve the desired goals effciently.
Vendor	Consists of manufacturers, suppliers and distributors.

KEY PHRASES

This section outlines the three (3) fundamental Key Phrases used in the study briefly, i.e. (i) Supply Chain Management (ii) Technological Capabilities and (iii) Competitive Advantage. Although the scope of the phrases concerned are indeed very wide, they are used within a limited context only. For example, the phrase 'Technological Capabilities' may include its use in a variety of contexts such as automation, engineering, etc. However in the present study it is limitted to the use of ICT solutions, especially in the context of Supply Chain Management (SCM). The meanings of the key phrases are better explored in the chapter on Literature Review. Indeed these three key pharases conceptualise the triangular association that forms the thematic concern of the present study.

Supply Chain Management (SCM) :

In the present study SCM refers to the practices and processes aiming for effective and efficient flow of materials and information between a firm and its network of suppliers and customers. SCM involves integration, co-ordination and collaboration across organizations and throughout the supply chain. In other words it refers to the management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at lesser cost than the supply chain as a whole (Christopher, 1998).

ii) Technological Capabilities :

In the context of this research paper, the phrase 'Technological Capabilities' refers to Information Communication Technology (ICT) based inter-organizational systems that provide innovative software solutions that are used for information sharing and/or processing across organizational boundaries within the limits and spectrum of Supply Chain Management. The technological capabilities approach represents a radical

alternative to the neo-classical framework that rests on the well-known conceptualization of technology as freely available, absorbed without any risk and costs and efficiently used by every enterprise. The phrase neo-classical framework refers to the modern day general economic approach that incorporates not only the input and output of resources, but price, profit and income distribution mechanisms leveraged by the phenomenon of supply and demand.

Additionally, these Technological Capabilities also extends to the skills required of technical, managerial or organizational faculty-abilities that firms need in order to utilize efficiently the hardware (equipment) and software (information) of technology, and to accomplish any process of technological change (Sanyal and Guha, 2010). These capabilities are firm specific knowledge, made up of individual skills and experience accumulated over time. Technological change is neither exogenous nor automatic, but rather it is the result of purposeful activities or in other words 'technological efforts', undertaken by firms. Most of the technological efforts do not take place at the frontier of technology. Individual efforts are required to make explicit the many tacit elements of technology and to access, implement, absorb and build upon the knowledge required in undertaking production and providing services (Farina and Zylberstztajn, 1994).

Nevertheless, the phrase Technological Capabilities in the context of this study, refers to some specific innovative elements in the SCM process that are unique. It refers to sophisticated systems applications that provide extraordinary ICT based innovative software solutions for information sharing and processing that enables internal and external intergration among partner organizations.

i) Competitive Advantage:

A firm is supposed to have gained competitive advantage when it performs strategically important activities at a much cheaper cost compared to its competitors in similar

industries (Porter, 1985). The role and contribution of SCM in gaining a competitive advantage is embedded in the concept of relative performance with that of its rivals. In simple terms it refers to "what one firm has or possess while the other does not". In the present study this phenomenon is confined to how the sample firm utilise ICT based technologies (innovative software solutions) to the full extent, especially in the context of SCM operations to outperform its counterparts in the similar or homogeneous industry.

CHAPTER 1 INTRODUCTION

1.0 Introduction

A bird's eye view of the global economy might reveal the fact that the basics of business competition has changed and no longer companies competing against other companies , but rather supply chains are competing against supply chains (APO, 2001). Indeed, the success of a business is now invariably measured not by sophistication of its product or by the size of the market share but the effective use of innovative strategies in SCM by individual firms. The market environment is gaining rapid progress with the advent of ICT based technological capabilities (Jong-dae Kim, 2001). As a result, manufacturers are under pressure to better manage their supply chain and continuously strive to improve manufacturing efficiency and logistics operations (Chen et. al.,2003). The current trend now is seeing in the light of the ability to forcefully and deliberately harness their supply chain to deliver responsively to customers as and when they demand it (APO, 2001). The increasingly complex global relationships among supply chain partners, i.e. suppliers, manufacturers, distributors, retailers and the final consumers inevitably compound these pressures. As Doonan et al. (2005) claims, customer demands have now become the most important type of external pressure. These pressures are driving manufacturers or buying houses to reduce cost, reduce order cycle times, and to improve their operating efficiencies (Kalakota and Robinson, 2001).

1.1 The Background

The background features of the present study are rooted in the context and importance of Supply Chain Management in business organizations. As such, the first part of this section throws some light on the significance of SCM. However, the other pertinent aspects of SCM are explored and discussed in the Literature Review. The following

section (the second part) delves into the **problem statement**, which underpins the purpose of the study.

1.2 Supply Chain Management

The Supply Chain Management (SCM) approaches are progressively recognized by many organizations as a strategy to attain their business goals of today (Chin, et al., 2004; Altekar, 2005). SCM practice has become one of the new era manufacturing paradigms for organizational sustainability and competitiveness (Gunasegaran, 2004). Globalization, continual technological advances, and an ever-changing customer demand for new products have brought about new managerial practices and business models and one area that has clearly benefited the most from new technologies is Supply Chain Management (Sanyal and Guha, 2010).

The advent of technological developments and the emergence of the internet have caused the SCM practices to compete both at domestic and international levels. The internet based computing and communications strategies has made business organizations achieve greater coordination and collaboration among supply chain partners and indeed automated the supply chain process tremendously (Akkeran and Cavaye, 1999). SCM applications underpinned by technology platforms have enhanced the abilities and capabilities of organizations to integrate their work processes through collaborative information sharing, processing and planning strategies (Charles et al., 2001). As such, SCM processes in organizations are increasingly gaining importance especially in terms of internal and external system integrations. Effective SCM operations underpinned by technological capabilities provide the firms with competitive advantages (APO, 2001).

1.3 Problem Statement

'The problem statement describes the context for the study and it helps to identify the general analysis approach' (Wiersma, 1995,p. 404). In the present study, the research problem revolves around the effective use of supply chain management processes.

It has been noted that with the advent of technological progress, supply chain management and global operations have now evolved into primary sources of competitive advantage for firms. As today's marketplace is becoming more fiercely competitive than ever before, only the factors of competitive advantages may ensure the continuous survival of a firm. As per the arguments in the APO (2001) symposium the very nature of competition among business entities is changing and companies will no longer compete against other companies but foresee a world in which supply chains will compete with other supply chains for market supremacy.

In this respect, supply chain management is deemed the integration and strategic alliance involving all the value-creating elements in the supply, manufacturing, and distribution processes from raw material extraction, the transformation process, and end user consumption (Razak et al., 2010).

SCM practices pose a multitude of challenges to many manufacturing companies. For instance, the demand from customers is subjected to changes. According to Lummus and Vokurka (1998), demand changes occur intermittently and are hard to anticipate. Customers are used to requesting products in a short time frame and they increase demands without prior agreement with the company. Besides, there tend to be high supplier dominance in manufacturing companies. This means that companies seldom have the power to shape the relationship with the supplier and must accept quality, price decision, terms, and conditions that are dictated or prescribed by the supplier (Cox et.

al., 2003). Thus, companies on the receiving end has to adapt to flexible relationship with suppliers as they (suppliers), lay or impose restrictions on the company such as conditions of non-cancellation of product order, non- rescheduling of supply time and non-returning of products that may not comply with quality.

Moreover, many companies involved, especially in the manufacture of electronic products (as in the directions of the present study) tend to lack of integrated software and system, both inside and outside the company (Ayers, 2001). This means some of the suppliers are unable to access the company's supplier portal because they have incompetent devises supported by sophisticated technology. As such, it causes lower supplier response time as they need to update the purchase order manually. Some of the other likely challenges are such as no shared value in corporate culture in terms of commitment and cooperation (Mello and Stank, 2005), and key SCM operations like customer satisfaction, product quality, delivery precision and capacity constraints. According to Mello and Shank (2005) these challenges, although attributed to other factors to some extent, they are mainly the resultant effect of lack of technology. These situations further gives rise to work force issues that are not being measured on timely basis; likewise, the flow of material in the company is jeopardized by the high inventory and unreliable delivery of materials/goods.

The literature has acknowledged the importance of 'relationship quality' in the manufacturing industry for the SCM performance. Thus, relationships with customer and supplier are one of the major critical success factors for SCM efficiency. Previous research found that trust has strong prediction to a long-term relationship with customer and supplier (Sahay, 2003; Van Weele, 2005; Tumala et al., 2006; Chandra and Kumar, 2000). It is important to note that, obviously a 'hassle-free' supply chain relationship is the basis of trust.

According to Mentzer et al. (2001) Supply chain management must bring about improvement in the long term performance of a company via systematic and strategic coordination of the traditional business functions. However, the most intrinsic aspect of SCM is the customer focus and the added value that might ensure customer satisfaction (Lambert, 2008; Hines, 2004). Most often the notion of 'added value' is embedded in the firm's ability to work at a reduced cost. In other words, cost must be lowered throughout the chain by mitigating unnecessary expenses, and removing bottlenecks while focusing on total systems efficiency and equitable reward distribution. Past research has indicated that the inefficiency of many firms failing in SCM practices may be due to inability in incorporating technological capabilities in their SCM (Spekman et al., 1998). Likewise research evidence also indicates that, the incorporation and effective usage of technological capabilities have turned around many electronics manufacturing firms into profitable organizations (Boubekri, 2001).

Looking at the current economic downturn and considering the uncertainties of the business world, effective SCM practices may well be regarded a rare skill which might provide the edge for a firm in terms of its competitive advantage (APO, 2001). As such, an investigation into the SCM practices and especially the need to incorporate technological capabilities in the SCM processes, as in the direction of the present study might be an important area of concern that deemed necessary and highly desirable. For the convenience and understanding of the reader(s) the following features simplifies the inherent elements of the 'problem statement' into its components:

- Frequent changes and variations in demand in the SCM
- Supplier dominance and dictation of terms by suppliers
- High inventory and unreliable delivery of materials/goods.
- Inflexible relationship with suppliers.

- Challenges in terms of customer satisfaction, product quality, and delivery precision, capacity constraints etc.
- Lack of an integrated technological system to monitor demand
- Inability in incorporating technological capabilities in their SCM

The simplification and revelation of the elements in the ‘ Problem Statement’ may help us to identify and pre-conclude the fact that the solutions for the above stated ‘problems’ are subjected to technological innovations and integrations. Problems such as meeting the challenges posed by customers in terms of satisfaction, quality, precision ad capacity etc., are partially or if not wholly embedded in the literature and thus concluded as **Lack of an integrated technological system to monitor demand and of organizational inability or the firm’s capacity to incorporate technological capabilities in their SCM practices.**

1.4 The General Purpose of the Study

In the light of the above argument, the purpose of this study is to explore how technological capabilities help to enhance the supply chain strategies in electronic firms. In particular **the present study endeavours to investigate the role of technological capabilities, i.e. ICT based innovative software solutions for the sharing and processing of information within the realm of SCM practices in an electronics manufacturing firm in Malaysia.**

As this is somewhat a unique investigation, the writer selected an international electronic firm in Malaysia that is reportedly well known for its ability to tap its potentials in its technological capabilities. As this trend among manufacturing companies is still new in the Malaysian context, the writer used a ‘case study like approach’ to collect data.

Research Questions

In order to yield the intended results, research objectives need to have a clear focus and be translated into measurable terms (Cavana et. al., 2001). Thus the above purpose was translated into the following **research questions:**

1. What are the strategic factors in SCM operations that determined the success of the selected Electronic Firms?
2. What 'Technological Capabilities' (ICT based innovative software solutions for information sharing and processing) are adopted by the selected Electronic Firms in the Malaysian context?
3. How the above stated 'Technological Capabilities' (i.e. ICT based innovative software solutions for information sharing and processing) are attributed to Supply Chain Management process and how they contribute to the success of the selected Electronic Firms?
4. How the ICT based Technological Capabilities at the sample firms help promote business gains among their partner firms, in the context of mutual supplier-customer relationships?

1.5 The Objectives of the Study

In the light of the literature and the endeavour to identify how factors that relate to technological capabilities enhance supply chain management in manufacturing industries, the following research objectives were considered:

1. To examine the various factors that determines the success of electronic firms in general.
2. To examine the nature, characteristics and the role of Technological Capabilities (i.e. ICT based innovative software solutions for information sharing and processing), in the success of electronic firms.

3. To identify the association between the above stated 'Technological Capabilities' and the success of Supply Chain management in electronic firms.

1.6 The Scope of the Study

Leveraging on the strength of efficient SCM practices, electronic manufacturing firms in particular, have been noted to be setting good examples in terms of their outstanding performance (Ai-Chin et. Al.,2010). In limiting the scope of this study, it is vital now to mention that a number of crucial factors are indeed becoming the determinants of SCM operations in electronics manufacturing industries, namely both the extensive and intensive use of ICT and the effective management of these capabilities by high caliber personnel in those industries (Jonsson and Gunnarson, 2005).

Hence, the scope of the study is limited to the use of technological capabilities, and the effective management of these technologies, especially in the form of ICT based innovative software solutions to address problems posed by the demands of SCM. In order to determine the correlation between SCM practices and firms' overall performance, this paper is set to explore the interwoven factors of SCM activities and the efficient use of ICT based technological capabilities (that provide innovative software solutions in the sharing and processing of information) in an internationally known prominent electronic manufacturing organization in Malaysia.

1.7 The Significance of the Study

This study is endeavoured to highlight the role of technological capabilities in the supply chain management. As supply chain management is increasingly becoming the decisive factor in determining the success of manufacturing firm (Altekar, 2005; Chin, et al., 2004), the results of the study would be helpful for other key players in the

industry. Companies now look beyond cost and quality advantage and are moulding their SCM operations, capitalising on the technological strength and the effective management of resources at their disposal. Speed, quality and flexibility are being emphasised as means of responding to the unique needs of customers and markets (Yusuf et al.,2004). It is believed that the knowledge of the use of technological capabilities will further boost the compatibility and competiveness, especially in the context of SCM operations, and at least among homogeneous industries.

The forces of globalization and technology are indeed changing the rhythm of the modern supply chains (APO, 2010). However, in many cases, the supply chains are said to be literally disintegrating. Product designers, marketers, and manufacturers that were previously housed in a single facility are now spread over several continents in organizations with different cultures, languages, and business objectives (Johnson, 2006). SCM in the modern era involves internal (intra organizational) and external (inter organizational) integration, co-ordination and collaboration across organizations and many times beyond the supply chain. As their global production systems become increasingly complex and integrated, firms need sophisticated models of SCM operations to allocate production and thereby serve the needs throughout the world (Ayers, 2001).

With reference to the above, the findings of this study would provide important implications for the management in companies engaged in Electronic Manufacturing and Supply (EMS) to understand determinants that contribute to the SCM success. More importantly, based on the results obtained, EMS companies can enhance the SCM performance by improving their current practices and strategies through the exclusive usage of innovative technological capabilities via ICT facilities and via the effective management of such technological capabilities.

1.8 The Firm of the Study : A Brief Background of The Sample Firm

The sample firm concerned in this study poised at the forefront of the global electronics manufacturing services (EMS) industry. It operates 36 manufacturing and design facilities worldwide, which includes their very own state-of-the-art plant Kulim, in the northern state of Kedah and Senai and Johore Bahru in the southern state of Johore, Malaysia. The Company has the distinction of being a leading provider of manufacturing technology and service solutions to industry leading 'original equipment manufacturers' (OEMs). This endeavour is observed primarily in the computer and communications sectors.

Headquartered in Toronto, the sample firm is a one of the key players in electronics manufacturing services (EMS). With its vast network the firm provides a broad range of integrated services and solutions to more than 200 OEMs (Original Equipment Manufacturers) in the computing, communications, aerospace and defence, automotive, consumer and industrial markets.

Established in 1917 as the manufacturing arm of IBM Canada, the chosen organization became a wholly-owned subsidiary of IBM Canada in 1994. In 1996, the management and Onex (Onex Corporation is a public investment firm specializing in acquisitions) acquired the company from IBM. In 1998. The organization completed the largest IPO in EMS history and become the largest technology IPO in Canada i.e. raising gross proceeds of US$414 million. In 1999, it was listed in the Toronto Stock Exchange's TSE 300 Composite Index and TSE 100 Index. In 2001, the firm announced a five-year strategic manufacturing agreement with Lucent worth up to USD$10 (million/billion).

The firm concerned constantly strives to become the "Partner of Choice" in the electronics industry, simply by setting the benchmark in industry through key areas such

as: Total Customer Satisfaction, Superior Value, Demonstrated Quality Leadership, and Technology Leadership.

It is a fact that the operators of the firm concerned have shown relentless effort in their pursuit for technological excellence. Having perfected their recipe for success, they have now set their sights on achieving a USD20 billion target (Celestica, 2010). The firm provides added advantage to its customers by improving time-to-market, scalability and manufacturing efficiency. The company's global business solutions include: design and engineering; manufacturing and systems integration; fulfillment and after-market services.

The firm concerned currently owns and operates approximately 10 million square feet of manufacturing space, with almost 48,000 employees across 19 countries in the Americas, Asia and Europe. The chosen organization is a publicly traded company (New York Stock Exchange) with a year 2005 revenue of USD$8.5 billion with its worldwide network of companies that has rooted in multiple locations worldwide.

The deal renders firm as the leading EMS provider for Lucent's North American switching, access and wireless networking systems products. This five years agreement help the firm to work with its supplier on large confirmed material orders that helps in lowering the material cost. Big orders enable the firm to leverage better costing authority.

In the year 2002, the firm expanded its geographic footprint into Asia, forming a strategic five-year s USD$2.5 billion outsourcing relationship with NEC Corporation and acquiring the OEM's manufacturing operations in Miyagi and Yamanashi, Japan. In 2003, the firm expanded its cooperation to Asia by opening a manufacturing facility in China.

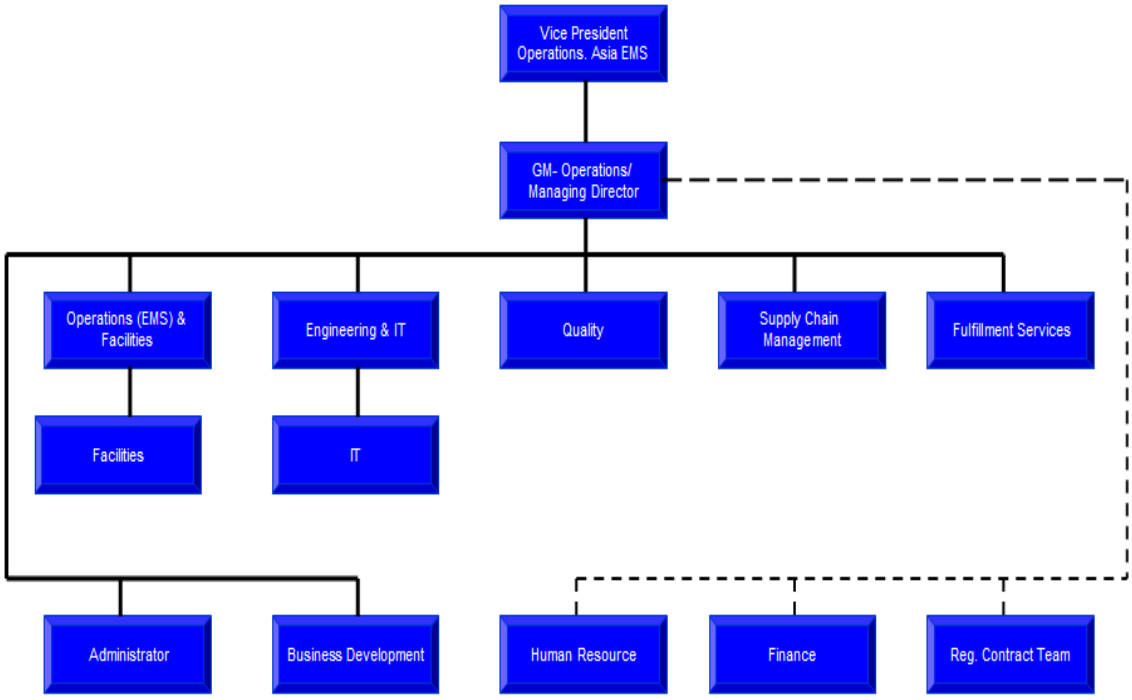


Figure 1.1 : Sample Organization Structure and Key Activities

This section provides a description of CH's overall performance profile. It also presents the background and historical growth of CH. This narrative highlights the technological capabilities achieved by CH over the years by having one of the lowest cost producers in board assembly in this region. It also highlights the main reasons CH is chosen as a sample for the research as this aspect of the business operation has proved to be extremely efficient in the manufacturing industry using their technological capabilities. In the interest of the reader (s) and in strengthening the choice of the sample for the

current study, a brief summary of the firm gathered from the Year Book, (Celestica, 2011) has been recorded below:

Sample company total operation is led by a General Manager. There are seven main departments. They are:

i) Operations & Facilities – handling the total production operation and plant facility.

ii) Engineering & IT – handling the research and development, design and IT support.

iii) Quality - ensures the output quality meets customer requirement and overall quality control.

iv) Supply Chain Management – handling the purchasing and procurement.

v) Fulfillment Services – handling facilities, systems, and personnel to process mail, packaging products, or performing other customers' requests.

vi) Administration - handling human resources, hiring & financial aspect

vii) Business Development handling New Project

1.9 Overview of the Chapters

This study is spread over six (6) chapters. As seen, the first chapter provides the introduction to this study stating the background, purpose, rationale and the problem statement as to why this study might be important. It reiterates the significance and the emerging new role of SCM practices and how they are increasingly becoming the competitive advantages for firms with their technological capabilities. It then, outlines the objectives, research questions and the scope of the study.

The second chapter begins with a brief report on two important aspects of philosophical paradigms of technology. The first one being Porter's (1998) Diamond Model that

relates as how firms can capitalise on Technological innovations in the absence of favourable conditions of production and other supportive factors. The second aspect touches on Geel's (2004) model of Technological Evolution, Diffusion and Transformation, a related theory on how firms undergo technological development. The second part of the chapter provides definitions of SCM and reviews literature on some of the empirical studies conducted in Malaysia as well as abroad on SCM practices. They include review of literature on how SCM practices contribute to competitive advantages in firms. The purpose of this chapter is to identify the possible gaps in the literature. Moreover, via the summary, the chapter also outlines the conceptual and theoretical framework that underpinned the design of the present study.

The third chapter is about the methodological framework used for the study. While reiterating the purpose, objectives and research questions in brief, it touches on the sample and sampling procedure and the reasons for a qualitative "Case Study –like" approach. In total it defines the methodological framework used for the study.

The fourth chapter deals with the findings gathered from in-depth interviews conducted with some of the senior personnel involved in the SCM operation, at the three branches of the sample firm. This section also highlights the interview findings from six of the customer-supplier representatives, which had helped in the triangulation of the overall findings. Thus, a comprehensive report is provided highlighting their perspectives as how technological capabilities (in the context of ICT based innovative software solutions to harness information sharing and processing) could possibly enhance SCM processes.

The fifth chapter summarises the findings of the study and discusses the importance and relevance of technological innovations in the SCM processes and how they provide the competitive advantages and to spearhead as industry leaders. The chapter also outlines

the nature of innovation and technological capabilities as capitalized by the sample firm in a much detailed order.

The sixth or the final chapter summarises the contents of the previous chapters briefly. The chapter outlines the implications of the study providing conclusions and stating suggestions as how other players in the industry can incorporate technological capabilities (ICT based innovative software solutions for information sharing and processing) to expedite their SCM processes. This chapter also cites some of the limitations and ethical constrains of the study.

CHAPTER 2 LITERATURE REVIEW

2.0 Introduction

The review of literature provides the background and context for the research problem. It establishes the need for the research and indicates that the writer is knowledgeable about the area' (Wiersma, 1995, P.406). In the light of this, it is reiterated that the purpose of this study is to seek empirical evidence on the notion that technological capabilities are increasingly gaining importance and hence becoming the backbone in SCM practices (Ai-Chin et al., 2010). In other words technological capabilities lead the firms concerned to outstanding performance and achievement in terms of profit and position in the industry. An attempt is made to review relevant literature on the use of technological capabilities (ICT based innovative software solutions for information sharing and processing) especially in the SCM practices. The purpose of this endeavour is to identify possible gaps in the existing literature, and this in turn might help to strengthen the purpose of the present study in the pursuit of contributing to new knowledge.

2.1 Chapter Overview

The literature base in this section is presented in three parts. The first part deals with two sub-sections that provides review of literature separately on two pertinent aspects of basic philosophy for modern thinking in the industrial settings. The first aspect is Porter's (1998) Diamond model which claims as how firms may achieve the desired 'competitive advantage' despite the lack of traditional advantageous factors that may be supportive or favourable in some industries. Porter's Diamond Model explains as how firms can deviate from the traditional norms of relying on supportive factors of production such as availability of natural resources, skilled labours and lucrative market

situations and the implications of it. The second aspect talks about Geel's (2004) model of technology conceptualisation, of technology innovation and technology diffusion, and how firms may use these potentials to capitalise on their niche areas. In a nutshell, Geel's conceptualization of technological innovation talks about how one main technology paves way for the development of other peripheral technologies and the transfer of technological knowledge in industrial settings. The writer believes that these two theoretical models or rather concepts are partially pertinent in the discussion of the success story of the chosen electronic firm in the study.

The second part of the literature review proposes an overview of various classification schemes of supply chain collaboration and definitions in general. The third part discusses as how SCM practices may incorporate technological capabilities to suit their needs and to bring about the desired competitive advantage. As per the requirement of the objectives of the current investigation, the third part of this section also focusses on **the role of IT technologies** in the success of electronic companies. This is because the emphasis in this current study is on how electronic companies in particular gain their competitive advantage via **Supply Chain Management** (SCM). The following flow chart (Figure 1) explains the order of the presentation

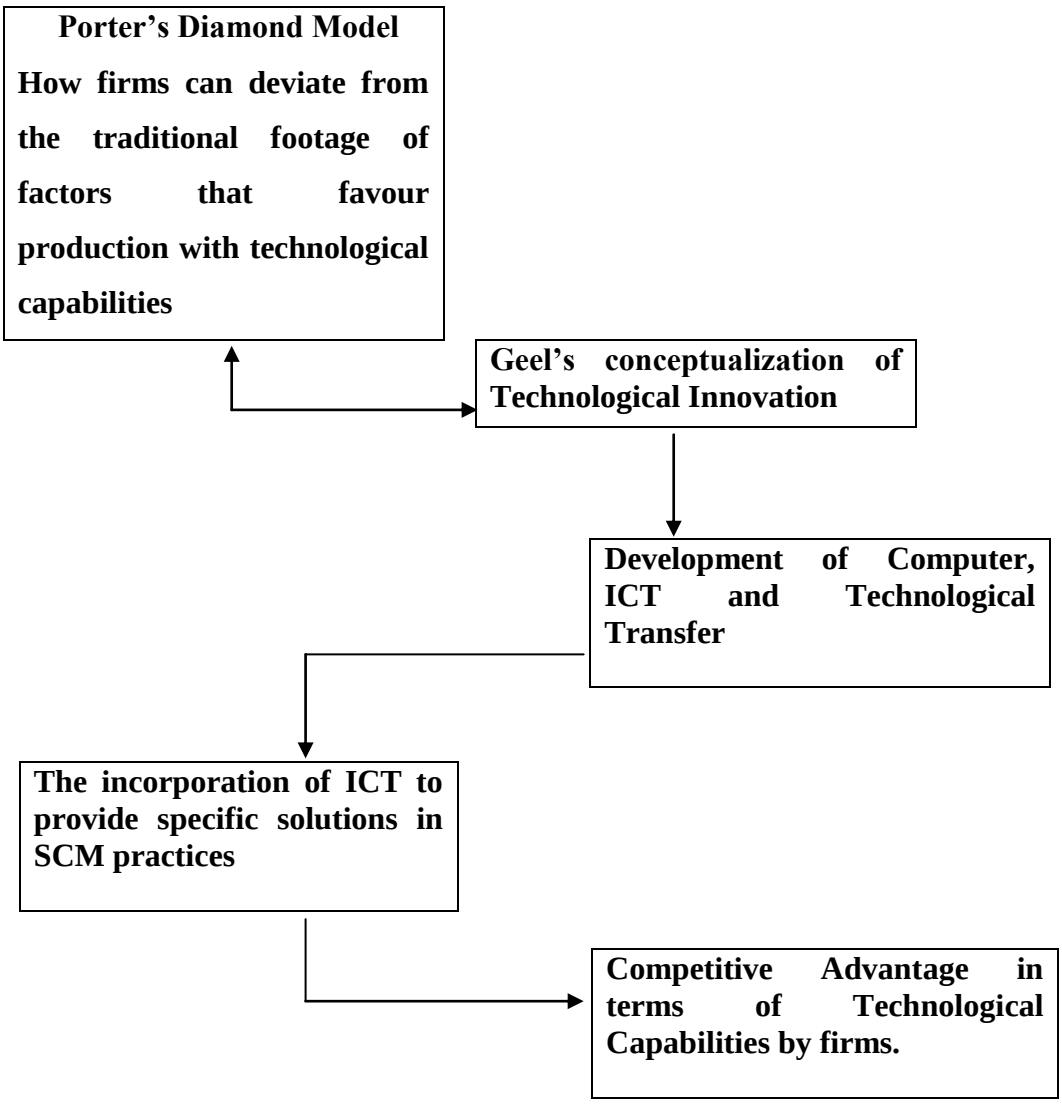


Figure 2.0 Configuration of Technological Base (Porter & Geel) in SCM Practices Leading to Competitive Advantages Among Firms.

2.2 Literature Review (Part One)

The present study attempts to capture the use and management of technological capabilities or rather as used in the present study (i.e. ICT based innovative software solutions for information sharing and processing) in a selected firm in the context of Supply Chain Management (SCM). This is viewed in the light of Porter's (1990) and Geel's (2004) work as one of the two basic underpinning philosophical aspects that motivate firms in the acquisition of technological capabilities.

Porter's Diamond Model:

The Porter Diamond' is a model that helps analyse and improve a nation's role in a globally competitive field. The model was developed by Michael Porter (1998), a recognized person and an authority on company strategy and competition. Porter's diamond model is noted as a more proactive version of economic theories that quantify comparative advantages for countries or regions. Michael Porter's "*The Competitive Advantage of Nations"* has changed completely the conception and notion of how prosperity is created and sustained in the modern global economic arena. Porter's seminal study of international competitiveness is shaping or has shaped national policy in many countries around the world. It has also transformed the way of business and management thinking, decision making, and of actions not only in firms and organizations but states, cities, companies, and even regions across the globe.

In his theory of competitive advantages Porter argues why particular industries become competitive in particular geographical locations (Porter, 1998) In his generalized diamond model , competitiveness is defined as the capability of firms engaged in value added activities in a specific industry in a particular country and to sustain this 'value added activities' over long periods of time in spite of international competition.

In the endeavour to strengthen his argument Porter identified a number of very successful industry clusters. The clusters concerned are actually geographic concentrations of interconnected companies, specialized suppliers, service providers and associated institutions in a particular field of industrial endeavour that are present in a particular nation or region. In Porter's words it is their geographical closeness of these clusters that distinguish them from innovation networks. The concept of clusters arise because they increase the productivity with which companies can compete.

Porter makes a clear distinction between geographic scope of competition and the geographic locus of competitive advantage (Porter and Armstrong, 1992). In the second, order, the concept of sustainability may require a geographic configuration spanning or involving many countries, whereby firm specific and location advantages present in several nations may complement one another. In contrast, Porter (1990; 1986) strongly suggests that the most effective global strategy is to concentrate as many activities as possible within the clusters in one country and then to serve the world from this home base.

Porter's approach looks at specific clusters of industries, where the competitiveness of one company is dependent on or related to the performance of other companies and other factors knitted together in the value-added chain, in customer-client relation, or in local or regional contexts (Porter, 1990). In contrast many countries were adhering to the belief that the notion of competitive advantage of some nations directly concerns or relates to or certain favourable factors available to them.

At one stage of time people believed that all the various factors of production such as land, capital, labour and market were the determinants of 'comparative advantage' to nations that in turn gave them the 'competitive advantage' to firms in those nations to prosper in the international market. However, Porter's research on the *The Competitive Advantage of Nations* compounds a new theory of 'competitiveness' based on the causes of the productivity with which companies now can not only compete but even excel. Porter shows how traditional comparative advantages such as natural resources and abundance of labour as well as proximity to of consumer markets have been superseded as sources of prosperity. Porter claims that the availability of and how broad macroeconomic accounts of competitiveness are insufficient (Porter, 1990).

The popularly known ‘Porter's diamond’, allows a whole new way to comprehend the competitive position of a nation (or other locations) and in the context of global competition. The phenomenon is now an integral part of international business thinking. Porter's concept of "clusters," or groups of interconnected firms, suppliers, related industries, and institutions that arise in particular locations, has now become a new way for business organizations to think about economies, and assess the competitive advantage of locations, and for the setting of public policy.

In a nutshell Porter claims that the determinants of competitive advantage are not inherited but developed (Porter, 1990). As mentioned earlier, the approach looks at clusters of industries, where the competitiveness of one company is subjected to the performance of other companies and other factors knitted together in the value-added chain, in customer-client relation, or in local or regional contexts. The Porter analysis is viewed in two steps. First, clusters of successful industries have been mapped in or under important trading partner nations. In the second, the history of competition in particular industries is examined to clarify the dynamic process by which competitive advantage was created.

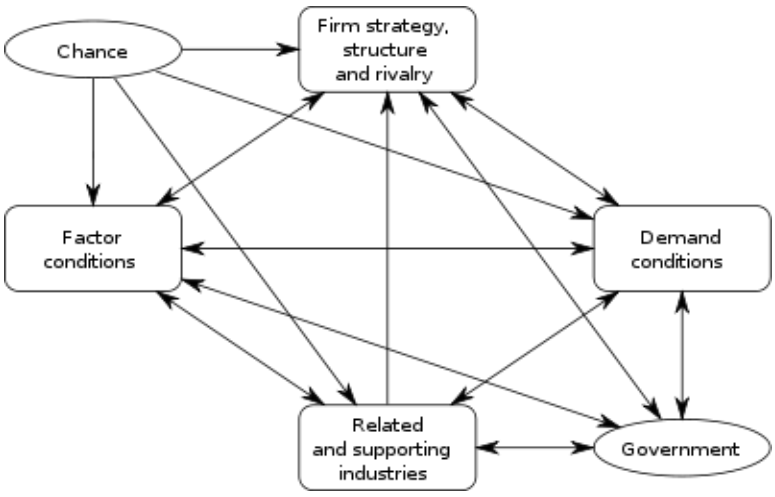


Figure 2.1 Porter Diamond : Key Tool For The Analysis Of Competitiveness
(Adopted from Porter (1990)

The basic methods in these studies are virtually historical analysis and the phenomena analysed are classified under six broad factors incorporated into the Porter Diamond, which has become a key tool for the analysis of competitiveness:

Factor conditions basically refers to human resources, physical resources, knowledge resources, capital resources and the infrastructure. Specialized resources are often found to be industry specific and are deemed important for their competitiveness. Conversely, it is claimed that a firms specific resources can be created to compensate or offset factor disadvantages.

Demand conditions is seen especially in the context of the home market as something that can help companies create a new atmosphere for competitive advantage. This might be possible or applicable when affluent home market buyers trigger or pressure firms to innovate faster and to create more advanced products and services than those of competitors.

Related and supporting industries can impact or produce inputs which are important for innovation and internationalization. Innovation process can take the form of a chain reaction. The related industries may provide cost-effective inputs and along the way they also participate in the upgrading process, thus stimulating other companies in the chain to innovate and move on the rungs of the economic ladder.

Firm strategy, structure and rivalry supposed to account for the fourth determinant of competitiveness. The way in which companies are created, set goals , strategies their business, and the way they are managed is important for their ultimate success. However, the presence of intense rivalry in the home base is also important and cannot be ignored. The element of rivalry creates pressure to innovate in order to upgrade or boost competitiveness. Robson (1997) defines strategy as: The pattern of resource

allocation decisions made throughout an organization. From these statements it is clear that there should be some form of intelligence in business that is strategically projected and concerned with the agile re-composition of resources in fast-changing environments. Literature sources lately have focused on hyper-competition among organizations with similar capacities. The idea behind these literature sources is to model business capabilities based on a strategic direction together with innovative principles and with appropriate management styles to adapt to change.

Government, as one of the strategic component can influence and enhance each of the above four determinants of competitiveness. Clearly government can influence the supply conditions of key production factors, demand conditions in the home market, and boost competition among firms. Government interventions can take place at various levels such as local, regional, national or international level.

Chance, as a final component of the diamond refers to events or occurrences that are outside the control of a firm. These phenomenon is purely subjective but they are important in a sense that they create discontinuities whereby some gain competitive positions and some lose out in the process.

The above stated factors clearly integrate the important variables determining a nation's competitiveness into one model. Most other models designed for this purpose represent subsets of Porter's comprehensive model. However, substantial ambiguity remains regarding the signs of relationships and the predictive power of the 'model' (Grant, 1991).This is mainly because Porter fails to incorporate the effects of multinational activities in his model (Rugman, 1992) To solve this problem, Dunning (1992) for example, treats multinational activities as a third exogenous variable which should be added to Porter's model. In today's global business, however, multinational activities

represent much more than just an exogenous variable. Therefore, Porter's original diamond model has been extended to the generalized double diamond model (Moon et al., 1995) whereby multinational activity is formally incorporated into the model.

Perhaps Porter's Diamond Model (Porter, 1990) could explain and substantiate the writer's claim to explain the success criteria of the chosen firm in the present study. It is the writer's contention that the six elements touched by Porter in a way have all given rise to the 'Technological Capabilities', one of the desired outcome that has made the chosen firm somewhat unique. Porter argues that the 'technological capabilities' in particular developed by a firm can give the 'competitive advantage' over the others and can help it to become the front runner in the industry.

2.3 Geel's Model of Technology Conceptualization and Innovation

Geel's (2004) model claims that the common view of major system changes in organizational settings involves technological substitutions. An essential element in this technological substitution view is the concept of dominant design, originating from industrial economics. When a new technology first emerges, it gives rise to a variety of design variants and uncertainty. Through learning process and competition, one design variant becomes dominant, leading to closure and stabilization. Then, the dominant design forms the basis for consolidation and formation of a new industry, organizing other peripheral elements around it.

Although technological substitution is an important pathway for major system change, Geels, (2006) argues that most often firms build or base their technological innovations on one major or key technology. In other words, technological substitution will be important primarily for sectors organized around one core technology. However, there

are also sectors that function through the interplay of multiple technologies which might be equally regarded important. Geels calls these phenomena as the 'building on the multi-level perspective' (MLP).

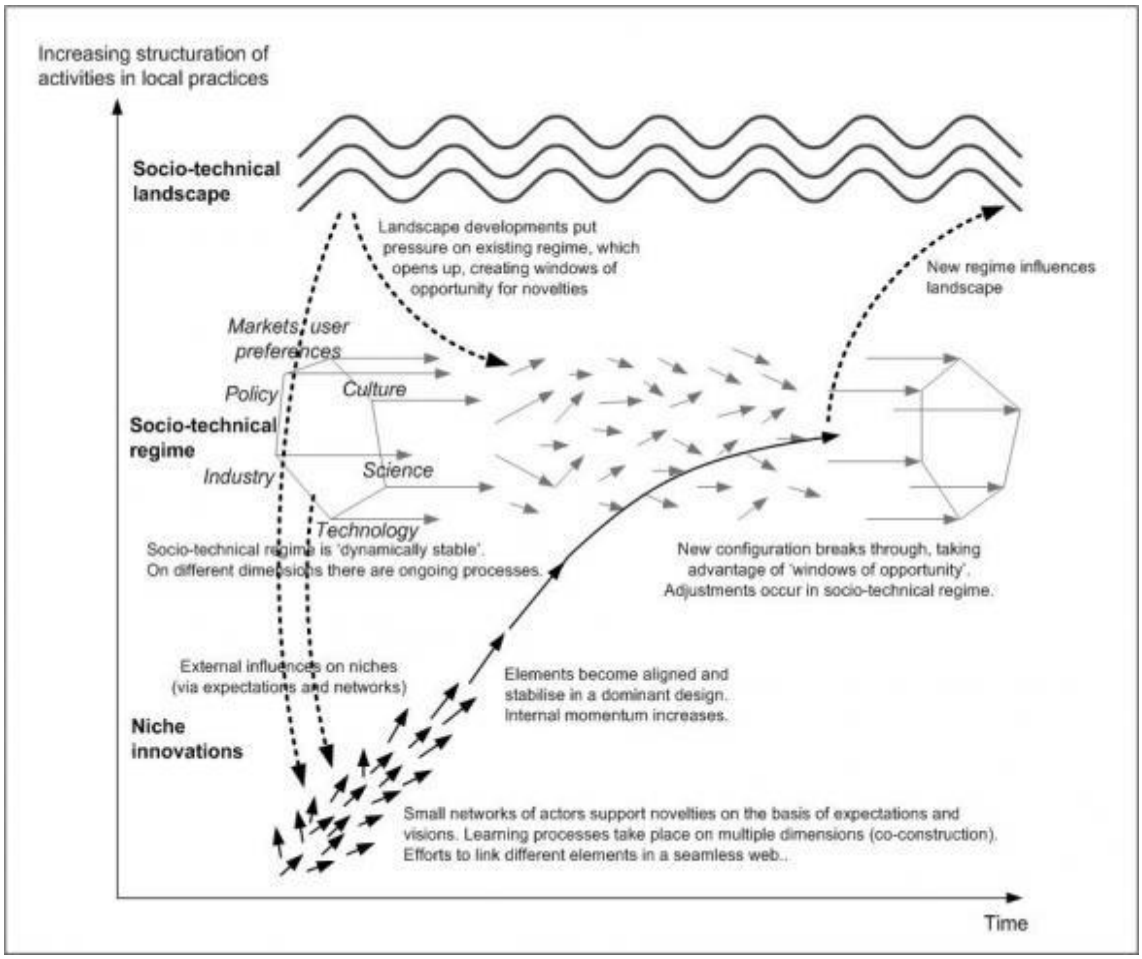


Figure 2.2 Geels : Building On The Multi-Level Perspective (MLP)

Adopted from Geel (2004)

Geel argues that in order to investigate innovation at system level, not only technological change but also changes in user practices, markets, regulations, culture and infrastructure, which altogether constitutes the socio-technical regime, should be addressed. This model portrays the dynamic nature of system innovation through a layered structure. According to this model, the stability increases and rate of change decreases towards upper levels of the socio-technical system, but the depth and influence of change increases towards lower levels. Nevertheless the change does not

happen in a linear fashion and the relationship between the three levels is similar to a nested hierarchy. The layers have internal dynamics as well as influencing changes at other levels and the central focus is at the middle where the socio-technical regime resides.

According to Geels (2005, p.83) novelties emerge in technological and/or market niches. Niches are crucial for system innovation, since they provide the seeds of change. The emergence of niches is strongly influenced by existing regimes and landscape and the influence from the regimes on niches is stronger and more direct than the influences from landscapes, which is more diffuse and indirect". The niches are loosely structured and there is much less co-ordination among people involved in the process. The regimes are more structured than niches and the rules of the regimes have co-coordinating effects on players through a strong guidance of the activities of the players. However, landscapes are even more structured than regimes and are more difficult to change.

Nevertheless, as the above figure (Figure 2) suggests, landscapes influence change both on niches and regimes; in return, niches (may) change the regimes, and the new regime changes the landscape in the longer term. The socio-technical landscape in this model is relatively static, stands for the external context and represents the physical, technical and material setting supporting the society, and cannot be changed by the players in the short-term. Landscapes are constituted by rapid external shocks, long-term changes and factors that do not change or change only very gradually. In order to manage systemic transitions, the lowest level of MLP model, i.e. the niches, play an important role since radical innovation takes place in niches whereas in socio-technical regimes innovation is incremental. The niches consist of promising innovations and they have to be

protected in order to enable them to develop from an idea or a prototype to a technology that is actually being used.

Sustainability issues are among the landscape developments and put the socio-technical regime under pressure (but only if they influence the regime immediately). Some of the responses have been to enforce regulatory measures on organizations which respond to these regulatory measures through compliance. On the other hand, given that governmental policy is developed with a short-term outlook, the legislative enforcements, although helping with optimization and efficiency increases, are unlikely to be the most effective leverage points to transform systems. In cases where sustainability issues are significantly relevant to a particular sector, and if organizations are prone to forward looking, there may be some voluntary action taken with a longer-term approach. This phenomenon is seen in some of the fresh produce growing industries strategizing to respond to impacts of climate change on their business. However, unless the signals from the landscape are immediately relevant to the socio-technical regime, the regime will continue with business-as-usual.

Reasons for the use of Porter's and Geel's model in the present study.

Porter's diamond model approach looks at how the competitiveness of one company is related to the performance of other companies and other factors tied together in the value-added chain. The second step in Porter's analysis deals with the dynamic process by which competitive advantage is created. The phenomena that are analyzed are classified into six broad factors incorporated into the Porter diamond, which has become a key tool for the analysis of competitiveness.

However, in the context of the present study, the choice of Porter's Diamond model in the present study indicates the importance of 'competitiveness' for the success of

business operations. An attempt was made to show how the selected firm for the case study achieved its competitive advantage over its business rivals. Moreover, the very essence of the study is also centered around the concept of competitive advantage in the context of 'sharing of information' among collaborating parties and of partner firms. The sample firm achieved its competitive advantage via the introduction of technological innovations and ICT based software solutions that expedited 'communication' aspects in the SCM operations by leaps and bounds.

Geel's (2004) model claims that the common view of major system changes in organizational settings involves technological substitutions. Although technological substitution is an important pathway for major system change, Geels, (2006) argues that most often firms build or base their technological innovations on one major or key technology. In other words, technological substitution will be important primarily for sectors organized around one core technology. In the context of the present study, Geel's model explains the importance of technological developments and of substitutions. The selected sample firm has developed its technology in the context of ICT based innovative solutions as prescribed by Geel's model.

In conclusion, both Porter's diamond model and Geel's model emphasise the importance of technological innovations for the formulation of competitive advantage for business entities for profit maximization and to combat rivalry. As such, both models in a consolidated form have directly and indirectly answered the research questions raised for the present study.

2.4 Literature Review (Part 2)

The Role of SCM Practices

Supply chain management (SCM) is the management of a network of interconnected businesses involved in the ultimate provision of product and service packages required by end customers (Harland, 1996). Supply chain management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption. Today, SCM could be regarded a single, integrated function that is responsible for all aspects of material flow, as well as financial and information exchange among business partners within the chain. Thus, supply chain management is aimed at managing complex and dynamic supply and demand networks. In the words of Harland (1996) SCM practices refer to the management of a network of interconnected businesses involved in the ultimate provision of product and service packages required by end customers.

Many studies on effective SCM practices propose material flows management factor as an important predictor for SCM performance as well. Thus, the very aim of a supply chain is to keep materials flowing from source to end-customer (Harrison and Hoek, 2005). Good flow of material ensures products are delivered to end customers on time or on schedule. Childerhouse et al (2003) who found that management of a smooth material flow is a key factor in achieving superior supply chain performance support this notion.

In the words of Jitpaiboon (2005) A supply chain is a network of companies connected via a set of serial and parallel supplier- customer relationships, from the first supplier to the final customer. A supply chain involves an interwoven coordination of logistics planning activities among supply chain members, which include all of the capabilities and functions required to design, fabricate, distribute, sell, support, use, and recycle or

dispose of a product, as well as the associated information that flows up and down the chain. In other words supply chains are typically comprised of geographically dispersed facilities and capabilities, including sources of raw materials, product design and engineering organizations, manufacturing plants, distribution centers, retail outlets, and customers, as well as the transportation and communications links between them.

According to Jayashankar et.al (1997) a supply chain can be defined as a network of autonomous or semiautonomous business entities collectively responsible for procurement, manufacturing and distribution activities, associated with one or more families of related products. As a matter of fact different entities in supply chain operations are subject to different sets of constraints and objectives. However, these entities are highly interdependent when it comes to improving performance of the supply chain, in terms of objectives such as on-time delivery, quality assurance and cost minimization.

A customer focused definition given by Hines (2004:p76) claims that "Supply chain strategies require a total systems view of the linkages in the chain that work together efficiently to create customer satisfaction at the end point of delivery to the consumer. As a consequence, costs must be lowered throughout the chain by driving out unnecessary expenses and focusing attention on adding value. It is apparent that while efficiency is being increased, bottlenecks must be removed. A successful logistics network can reduce entire supply chain costs, including manufacturing and procurement costs, inventory handling costs, facility costs (fixed costs),labour cost and transportation costs (Kaminisky and Simchi-Levi, 2000). Performance measurement must focus on total systems efficiency and equitable reward distribution applies to those in the supply chain, adding value. Hence, it is claimed that the supply chain system must be responsive to customer requirements.

Corporate culture is regarded as another essential feature and a factor for SCM success. In addition, organizational shared values in terms of extreme trust commitment and collaboration, organizational capability and top management supports are also essential for an effective SCM (Mello and Stank, 2005). Tony and Kelvin (2007) suggest that human factor significantly affects the SCM effectiveness. The human factors affect management of various stage and process in a supply chain, as employees are the key asset to drive supply chain performance. Additionally, measurement or rather the evaluation procedures are very important and are the only approach to understand whether process performance is improving or worsening and whether corrective action and intervention are required urgently (Roussel and Cohen, 2005).

As stated, this section on Literature Review is divided into two (2) parts. The first part defined SCM practices in general and some of the factors that featured as the determinants of SCM practices. In view of the purpose and objectives of the current study the literature review has identified customer trust, good customer relationship and customer satisfaction as some of the main determinants of SCM. These are the underpinning elements which lead to the success and sustainability of SCM. However, based on the theories of Porter (1998) and Geel (2004) it is the technological capabilities of firms that help in the smooth-running of the SCM process. The smooth-running of SCM process in turn helps to earn the trust of the suppliers customers and all the other stakeholders concerned.

2.5 Strategic Alliance, Integrated Relationship, Customer Trust and Satisfaction in SCM

A successful strategic alliance and integrated relationship with suppliers and customers must be revolved around trust, loyalty, positive sum-game (a win-win relationship),

cross-functional teams, achieving common goals and collaboration (Chandra and Kumar, 2000). Spekman et al. (1998) suggests that a firm's success is linked to the strength of its relationship with supply chain partners and it could reduce or increase revenue. Choy et al. (2003) claim that the long term success of a firm depends on the reliability of its suppliers and level of satisfaction of its customers. In this respect previous research found that collaborative relationship between customer and supplier has positive significant influence on SCM performance improvement (Bartlette et al., 2007; Ounnar et al.,2007; Vereecke and Muylle, 2006; Humphreys et al.,2001; Valsamaki and Sprague, 2001; Fearne and Hughes, 1999). Considering the above, Wong (2002) exploration concludes that supplier satisfaction and contribution lead to customer satisfaction and the overall improvement of SCM performance.

Past literature also indicates that a good, trust-based and long-term relationship with customer and supplier leads to high performance of supply chain. A successful strategic alliance and integrated relationship with suppliers and customers must be revolved around trust, loyalty, positive sum game (a win-win relationship), cross-functional teams, achieving common goals and collaboration (Chandra and Kumar, 2000). Adding to this view, Spekman et al. (1998) suggests that a firm's success is linked to the strength of its relationship with supply chain partners and it could reduce or increase revenue. As reliability becomes the underpinning element in customer trust, it is emphasized here that the long-term success of a firm depends on the reliability of its suppliers and level of satisfaction of its customers (Keny and Victor, 2003).

Previous studies had also noted that collaborative relationships between customer and supplier have positive significant influence on SCM performance and improvement (Julien and Baines (2007). In other words, a healthy relationship between customer and supplier relationship leads to the element of trust on the part of both parties and a

smoother running of the SCM operations. In this regard, Wong (2002) also supports the notion that reliability, trust on the part of supplier contributes to customer satisfaction, and it eventually leads to better SCM performance.

Supply Chain Management (SCM) is the management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole (Christopher, 1998). SCM involves integration, coordination and collaboration across organizations and throughout the supply chain. In other words SCM requires internal (intra-organizational) and external (inter-organizational) integration. In this respect, Stevans (1989) suggests that firms must achieve a relatively high degree of internal integration (collaboration among internal processes before implementing SCM.

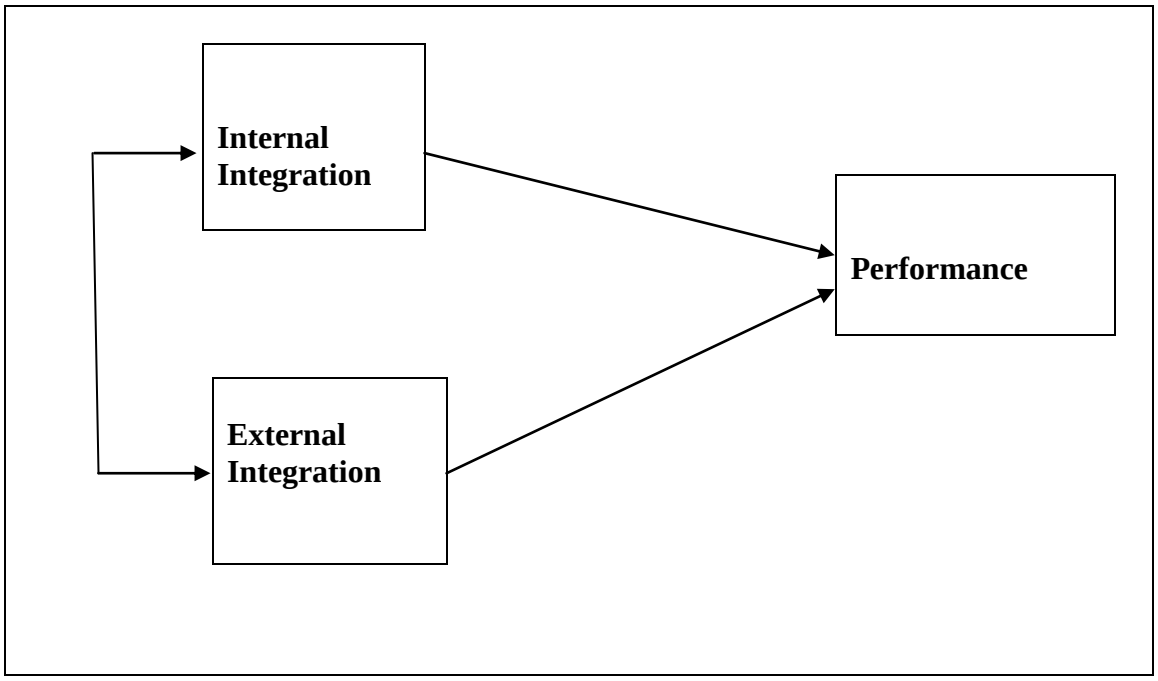


Figure 2.3 Factor Effecting Performance

(Adopted from C.Gimenez and Ventura (2003)

Internal integration is the integration across functional boundaries within a firm. The level of internal integration is reflected by the extent to which logistic activities interact

with other functional areas, as well as by the extent to which logistics is or is not a separate functional unit (Stock et al., 1998). The authors define external integration as the integration of logistics activities across firm boundaries. It is to think of the manufacturing enterprise in terms of the entire supply chain, which increasingly consists of many separate firms embedded together in network arrangements.

2.6 Supply Chain Management Models

Fisher (1997) suggests two distinctive approaches, efficient supply chain and responsive supply chain, to design a firm's supply chain. The purpose of an efficient supply chain is to coordinate the material flow and services to minimize inventories and maximize the efficiency of manufacturers and service providers in the chain. The supply chain model best fits the environment in which demands are highly predictable; forecasting error is low, product life cycle is long, new product introductions are infrequent, product variety is minimal, production lead- time is long and order fulfillment lead-time is short. Thus, the efficient supply chain design matches competitive priority emphasizing on low cost operations and on-time delivery.

On the contrary, Fisher (1997) states that the purpose of responsive supply chain is to react quickly to market demand. This supply chain model best suites the environment in which demand predictability is low, forecasting error is high, product life cycle is short, new product introductions are frequent, and product variety is high. The responsive supply chain design matches competitive priority emphasizing on quick reaction time, development speed, fast delivery times, customization and volume flexibility. The design features of responsive supply chains include flexible or intermediate flows, high capacity cushions, low inventory levels, and short cycle time.

2.7 Supply Chain Management and Competitive Advantages for Firms

A firm may gain competitive advantage by performing strategically important activities more cheaply or better than its competitors (Porter, 1985). A number of authors claim that SCM and information sharing can substantially involve better chain performance (Shapiro, 1984; Scott and Westbrook, 1991; Byrne & Javad, 1992; Cooper, 1993; Christiansee & Kumar, 2000). The study by Stank et al (2001) on manufacturers, wholesalers and retailers concludes that (i) internal and external collaboration are positively correlated (ii) internal collaboration leads to a better competitive position in some logistics service performance variables (speed, dependability, responsiveness, flexibility and overall customer satisfaction).

Enhancing supply chain performance is a critical approach for achieving competitive advantages for firms and organizations (Cai et al.,2009). Supply chain management approach is progressively recognized by many organizations as a strategy to attain the business goals of today (Chin et al.,2004; Altekar, 2005). According to Gunasekaran (2004), SCM has become one of the new era manufacturing paradigms for organizational stability, sustainability and competitiveness. In this respect many companies, especially those involved in the manufacture of electronic products and those in the electronic manufacturing services (EMS) industry are striving hard to achieve excellence in supply chain performance in order to outperform their business rivals.

Today's business-to-business world is made up of continuously growing supply chains which create a complex business environment that is hard to control. Huge networks made up of competing suppliers, manufacturers and distributors create situations where individual decisions are affected by the decisions of other parties involved in the network. According to Aydinliyim (2007) the quality of the decisions depends on the

amount of information the decision makers have about other members of the supply chain. Today, many industry sectors have created portals whereby key information is shared amongst the members of the network. This allows the members of a supply chain to cooperate so as to reduce their individual costs as well as the cost of the entire supply chain (Aydinliyim, 2007).

Simatupang and Sridharan (2002) define supply chain collaboration as being two or more chain members working together to create a competitive advantage through sharing information, making joint decisions, and sharing benefits which result from greater profitability of satisfying end customer needs than acting alone.

During the past two decades, both business managers and academic researchers have shown considerable interest in understanding how information technologies (IT) help to create competitive advantage for a firm (Ganesh and Varun, 2005). The authors argue that by demarcating specific types of capabilities, we can contribute to better understanding of the sources of IT-based competitive advantage. Conceptually, they distinguish here between value, competitive, and dynamic capabilities as three distinct types of capabilities. Within each type, they identify specific capabilities, such as quality of the IT infrastructure, IT business experience, relationship infrastructure, and intensity of organizational learning, and present a model that describes relationships between these capabilities and competitive advantage. The authors then empirically tested the model using data collected via a national mail survey from chief IT executives from 202 manufacturing firms. While the quality of the IT infrastructure is hypothesized as a value capability and expectedly did not have any significant effect on competitive advantage, the quality of IT business expertise and the relationship infrastructure (competitive capabilities) did. The results of the study also indicate that the intensity of organizational learning (dynamic capability) was significantly related to all of the

capabilities. These results point to the importance of delineating capabilities such as relationship infrastructure that can facilitate differentiation in the marketplace, and dynamic capabilities such as organizational learning as an important antecedent to IT capability building.

Staying competitive in today's fast changing markets and business environments has become a big issue and a major challenge for many organizations these days. Naturally be able to foresee the future of the industry and have insight into customer's articulated and unarticulated needs are critical capabilities that organizations need to acquire in order to stay competitive. Despite the many economic odds currently experienced in many countries, the standard of living has never been as high as today (Simon, 2000) especially in organizations. The need for speed, effectiveness and efficiency has become part of the evolution of mankind and has become such an integral part of life that people almost cannot and do not want to live without it.

The forces that influence organizations and govern companies in their striving for improved competitiveness are often condensed into three factors labelled as the three C's: customers, change and competition (Simon, 2000). Capability represents the identity of a firm as perceived by both employees and customers. Capability is the ability to perform better than competitors, using a set of business attributes that is distinctive and difficult to replicate. Capability is a capacity for a set of resources to interactively perform a stretch task (1000Ventures, 2006). It is further said that organizational capabilities are considered to constitute the fundamental source of sustained competitive advantage (Grant, 1996a, 1996b)

There is a widespread view that existing management theory and practice is inadequate in our rapidly changing world and the emerging new economic order (Bryans & Smith,

2000; Kelly, 1998). This new economy is characterized by three distinguishing properties: globality; intangibility; and inter-connectivity (Coyle, 1999; Kelly, 1998). Strategy is and will always be part of business. Strategy lays out the plan ahead and provides direction to follow this plan.

Robson (1997) defines strategy as: The pattern of resource allocation decisions made throughout organisation. From these statements it is clear that there should be some form of intelligence in business that is strategically projected and concerned with the agile re-composition of resources in fast-changing environments. Many authors have lately focused on hyper-competition, where organizations have to adapt to changes in the competitive landscape in innovative ways. Enterprise architecture has been widely embraced as the route to this desired state:

a) Enable integrated business intelligence

b) Connect strategy to execution

c) Enable flexibility and adaptability, so that business capabilities can keep pace with changes in strategy.

King (1995) suggests that the vision of the organization should be the basis of the guiding architecture. Malhotra (1996) noted that the vision bridges the gap between where the firm is and where it wants to be, but that no single capability can provide a single sustainable competitive advantage. Porter suggested a similar view in his discussion of "complementarities". He argues that the synergies of various capabilities cannot easily be imitated by competitors and thus would provide the basis for a stronger position in the market place (Harrison, 1996, Pastore, 1995).

2.8 Literature Review (Part Three)

The Changing Role of SCM Practices

Information technology has enabled channel partners to trade goods, share information, and integrate their processes, thereby reshaping the inter-organizational dynamics and resulting in more efficient channels. Electronic integration of data and the automation of business practices has driven costs down and built sales by better satisfying consumer needs (Christiansee and Kumar, 2000). Thus the power of inter-organizational information systems (IOIS) is well known in the literature of information systems research.

The Role of Information Technology in SCM Practices

Enhancing supply chain performance is a critical approach for achieving competitive advantages for companies (Cai et. al., 2009). Changing customer and technological requirements force manufacturers to develop agile supply chain capabilities in order to be competitive (Yusuf et al., 2004). However, the resource competencies required are often difficult to be mobilized and retained by single firms. As such, it might be imperative for companies to co-operate and leverage competencies that are complementary.

As seen, one of the salient ways by which companies and production chains construct differential characteristics for competition is by adopting information technology. Besides the supportive relationships with customer and supplier, information and communication technology (ICT) is also one of the crucial factors of competitive advantages as ICT drives higher levels of supply chain integration. ICT is an enabler for organization to increase the communication and to disseminate information (Altekar, 2005). It has been argued that Information Technology (ICT) contribute to improving

coordination among various links in the Supply Chain Management (SCM) (Auramo et al., 2005). For example the technologies concern enable their agents to transmit and access information, stimuli and exert control along the sequential stages that comprise the operations needed to address the market situation (Farina and Zylberstajn, 1994). In the modern world, communication and information technologies are offering new opportunities for businesses to compete in the global arena with a variety of tools.

According to a report by APO (2001), the rapid penetration of new technologies such as the internet is transforming global commerce, shrinking the marketplace, forcing situations of highly unstable and unpredictable demand intensities, and shortening the lead times of critical information flow. Operating under this setting, a wealth of literature reports technology as a driver of change has affected the practices of many Multi-National Corporations (MNC) supply chain. Many of the MNC's supply chains are intricately link to the digital economy. As such, demanding and technology savvy customers around the world increasingly expect goods and materials to be deliver to their doorstep at "click-speed", by the courtesy of sophisticated network strategies and capabilities (APO, 2001).

According to Yusuf et al. (2004) the advent and advancement of information technology (IT), has indeed turned the world into a global village through transfers of information and is regarded a major driver of SCM integration. The author's claim that even spatially separated and distributed companies became integrated through computer or internet-based technologies. In this respect, along with the rest of the world, many companies in electronic manufacturing services (EMS) industry of Malaysia are truly striving hard to achieve superior supply chain performance in order to outperform its competitors.

In the light of the above it might not be an exaggeration to say that performance of any entity in a supply chain depends on the performance of other aspects of management, and their willingness and ability to coordinate activities within the supply chain. In other words, the availability and deployment of technological capabilities alone cannot ensure success in the SCM practices. It takes high calibre personnel to effectively utilise the capabalities concerned to bring about fruitful rewards. The global economy and increase in customer expectations regarding cost and services have influenced manufacturers to strive to improve processes within their supply chains. The key roles played by technological personnel via their effective management styles such as effective decision making and coordination of affairs leads to reduction in cost of products and services. This strategic measure to bring about positive changes in the SCM operations is often referred to as supply chain re-engineering (Swaminathan, 1996).

In terms of building relationships between manufacturers and distributers i.e. retailers, wholesalers and distributors, and in order to implement coordinating mechanisms and hence to attain greater efficiency in SCM, the partners concerned must share information. According to Bowersox and Closs (1996) , the basic notion of SCM is based on the premise that efficiency along distribution channels can be improved when the various agents involved share information and carry out joint planning. As per the opinion of Cooper et. al (1997) one basic condition for implementing SCM is that there be some level of intra and inter-organizational coordination.

According to Farina and Zylbertztajn (1994) such coordination involves a process of transmission of information, stimuli and controls along the chain for this latter to respond to changes in the competition environment. Thus, the use of information technology is considered a prerequisite for the effective control of today’s complex

supply chain management. Technology is an enabler in SCM for helping supply chain members to establish partnerships for better supply chain system performance (Boubekri, 2001; It is reiterated that the strength of effective SCM for many successful organizations lie in their technological capabilities. Although firms use a variety of technological capabilities that range from automation to sophisticated machinery and equipment and hence, the prominent aspect or the backbone of a firm's technological capabilities is the effective use of IT facilities (Yu et al., 2001).

Jonsson and Gunnarsson, (2005) and Gunasekaran and Ngai (2004) explored that information technology is an essential ingredient for business survival that improves the competitiveness of firms. Dawson (2002) defined that efficient supply chain network can offer substantial improvements in terms of productivity and customer satisfaction by providing online facility, real- time- information, networked around the organization in giving full supply chain visibility. Besides that, McLaughlin et al. (2003) found that successful firms around the world are partly dependent on their ability to apply IT to SCM. In addition findings from McLaren et al (2004) has shown that operational efficiency and operational flexibility have high relationship with SCM information system. IT enhances the service level of SCM, improves operational efficiency and information quality (Auramo et al.,2005)

According to Bowersox and Closs (1996), the basic notion of SCM is based on the premise that efficiency along distribution channels can be improved when the various agents or parties involved are able to share information and carry out joint planning. In the views of Cooper et al (1997), one basic criterion for the implementation of the SCM practices is that there be some level of intra-and inter-organizational coordination. According to Farina and Zylbersztajn (1994) such coordination involves a process of

transmission of vital information, stimuli and controls along the chain for the upcoming changes in the arena of competitive environment.

The scope and theme of SCM have evolved over the years (Evans and Danks, 1998) moving from internal-orientated to external-orientated, from a firm's boundary to country. In the same manner SCM has also moved from operational or transaction level to managerial and strategic level. On the same basis, supporting technology also evolved along with the advent of IT technologies.

In the earlier years the domain of SCM related IT applications was limited to transaction-orientated areas such as inventory management, order processing, etc., i.e. application of IT in a specific function orientated system. According to Evans and Danks (1998) this transformation was popularly known as automation, but merely replaced repetitive manual jobs. As such there was no critical process that brought about competitive impact, other than increasing or improving transaction efficiency. The management focus was only operational efficiency.

According to Jong-Dae Kim (2001), with the diffusion of global-scale competitive pressure, the focus of SCM was extended to various other avenues to include supplier base and distribution channels. As such the management focus has evolved from efficiency to effectiveness, such as the concept of Effective Customer Response (ECR). In order to maintain inter-organization communication channel, internal logistics processes and related accounting processes were integrated. Along with it the emergence of database and network technology has enabled information sharing and streamlining of cross-organizational processes. ECR and other inter-organizational integration tools such a EDI and various internet-related solutions were developed. In the 21st century, IT application and usage have started playing a critical role in

developing business strategies and handling transactions moving almost the entire business world into an IT enabling competitive era (Jong-Dae Kim, 2001).

Global firms often invest in procurement strategies, including carefully negotiated contracts, but fail to obtain the projected benefits because of poor global implementation of the strategy. Aligning business strategy and policy is often the real problem. In this regard, Johnson (2006) perceives that "Organizational Control Mechanisms Enhance Procurement Efficiency: Johnson (2006) relates as to how GlaxoSmithKline Improved the Effectiveness of E-Procurement". The author examined GlaxoSmith- Kline's sourcing practices to understand how to use information technology to improve compliance when organizational control mechanisms are not aligned with supply chain strategy. In other words he describe as to how Glaxo-SmithKline changed its information and compliance systems to increase the benefits it obtained from its procurement strategy.

In the light of the above, based on empirical data gathered from 16 Finnish industrial and service organizations, Auramo et al (2006) presents a classification of the ways in which companies use IT in SCM, and examines the drivers for these different utilization types. According to the findings of the study, the use of IT for SCM purposes can be classified into three main categories, namely: 1) transaction processing, 2) supply chain planning and collaboration, and 3) order tracking and delivery coordination.

According Clark and Lee (2000) one of the main benefits of sharing information is the reduced need for inventory. As a result, the supply chain achieves better performance in terms of financial returns, service level, and turn-around times. With information shared among the manufacturer and the retailer, the manufacturer can use the information about the inventory level of the retailer to manage the frequency, quantity, and timing of

the shipments- instead of waiting for the retailer to place orders. This practice, referred to as continuous replenishment process (CRP), enables the manufacturer to reduce the inventory necessary and to plan the shipments more efficiently.

2.9 Supply Chain Life-Cycle Management

Supply chain management doesn't end when products are sold. Many firms encounter their most important profit opportunities after they sell their original products. For these firms, service and after sales support have become strategic parts of their revenue portfolios. Moreover, the growing requirements for complete product-life-cycle engagement, including taking back products at the end of their lives, means supply chain strategies must expand their view of customer needs (Cohen et al in Johnson, 2006).

Suppliers contribute to the overall performance of a supply chain, and poor supplier performance affects the performance of the whole chain (Sarkar and Mohapatra, 2006). Supplier–manufacturer relationships are considered important in developing a sustainable competitive advantage for the manufacturer (Sheth and Sharma, 1997; Cannon and Homburg, 2001).

2.10 e-Procurement

Sanyal and Guha (2010) carried out a study, titled e-procurement initiative in an Indian Industry which is an indication of the changing trends in the modern SCM practices. The key areas are the investigation of internet based e-procurement systems and business to business electronic markets. The authors argue that technological advancement in the field of telecommunication and information technology has changed the business processes over the years. They note that online procurement (e-

procurement) is a technological solution to facilitate corporate buying using the internet and other information and communication technologies (ICT).

The purpose of e-procurement is to reduce cost and to improve operational efficiency in the procurement process. Given the potential benefits of the internet and other web-related technologies to revolutionize the procurement process Sanyal and Guha (2010) argue that numerous organizations worldwide have already adopted e-procurement as an attempt to leverage this technological infrastructure. Citing the Forrester Report (Wyld, 2004), the authors claim that seven out of ten firms in the US market were reported to have engaged in on-line procurement of strategic items and critical service, especially those products and services that are closely linked to the firm's production or service delivery. Moreover the report also states that organizations have experienced between 11% to 12% business growth via the adoption of e-procurement tools, and 35% of the respondents involved in the survey have reported cost reductions after engaging in e-procurement.

2.11 Technological Capabilities in Electronics Industry

Ariffin and Figueiredo (2004) investigated the extent to which firms in the electronics industry developed significant innovative technological capabilities. In terms of its purpose, this study has direct relevance to the present study. The paper examined whether innovative capabilities have spread to these two late-industrializing countries, Malaysia and Brazil. It provided evidence to the debate over internationalization of innovative capabilities and argues against existing generalizations. Internationalization of innovative capabilities is measured here by the technological capability types and

levels built within firms. The framework for capability-building identifies types and levels of technological capabilities.

The empirical evidence for this massive study came from 82 electronics firms—transnational corporation subsidiaries and local firms: 53 in Malaysia (25 in Penang and 28 in Klang Valley) and 29 in Manaus (Northern Brazil). Empirical evidence was collected during extensive fieldwork based on different data-gathering strategies. Both qualitative and quantitative data analysis methods were used. Contrary to common generalizations, the study found that the capabilities of most sampled firms had been upgraded to carry out diverse innovative technological activities.

Additionally, these capability-building efforts were found to have strong association with higher capabilities for local decision-making and control, automation level and efforts to increase exports. The study found firms that innovated to be competitive by reducing costs, being more productive, reducing lead time and producing better products—regardless of whether they were in a domestic market-oriented country or in an export-oriented country. Finally, the analysis and framework in this study challenge some existing perspectives on the internationalization of innovative capabilities to the late-industrializing context.

However despite the acknowledged importance of the use of information technology in supply chain management, the number of empirical studies, especially in the Malaysian context is limited.

2.12 Concluding Remarks

An important element that is frequently mentioned in the literature is the relationship among the various parties in the SCM. The results of the above literature review conceptualizes that this harmonious relationship is brought about by their ability to communicate effectively. An important strategy for managing integrated supply chains is to share information among supply chain partners. With the vast network of IT systems across the global supply chain, information and Communication Technology is playing a crucial role in multiplying the rewards of the business. In this regard firms that are good at capitalizing technological capabilities are becoming the frontrunners in business. This in fact gives these technological orientated firms, the competitive advantage over the others.

In the light of the above and in line with the objectives of the present study, **this paper endeavours to explore the association between SCM operations and technological innovations by firms, especially in the context of electronics manufacturing industry and what implications follow for their success. An attempt is made to unravel the link between the use and innovative explorations of ICT technologies and SCM practices in a selected Electronics Manufacturing Firm. The purpose is to show how this phenomenon helps the firm concerned to gain the desired comparative and competitive advantage respectively over its rivals in the industry.**

The need for a Conceptual and Theoretical Framework

According to Cavana et al. (2001), after having conducted the preliminary information gathering and completing the literature survey or review, and having defined the research problem both conceptual the and theoretical frameworks must be developed.

Zikmund et al. (2010) simplify the notion of Conceptual Framework as a generalised idea out a class of objects that has been given a name and abstraction of reality that becomes the basic unit(s) for theory development. Likewise in the words of Cavana et al. (2001) the Theoretical Framework is defined as the foundation on which the entire research project is based. It is a logically developed, described and elaborated network of associations among the variables that are deemed relevant to the problem situation and have been identified through such processes as interviews, observations and a literature survey. The authors also indicate that to some extent experience and intuition also guide in developing the theoretical framework.

The Development of Conceptual Framework

Both the conceptual and theoretical frameworks for the present study are developed via the review of relevant literature within the scope of this study. The conceptual frame work for the present study is formulated via the combination of a multitude of technological capability related factors that form the thematic concern of the study, such as :

a) Detecting Potential Suppliers (Approved Vendors). For example, using a software to identify potential suppliers using supplier codes, their current status and position to deliver supply in terms of capacity, time requirement and payment terms, etc.

b) Likewise, by using technological devices or software solutions, much of human errors (in the process of identifying potential suppliers) are eliminated. As errors are minimised or eliminated, a great deal of precious time is saved which leads to cost reduction.

c) In a similar manner it is much easier and convenient to gather information on aspects pertaining customer demands in terms of minimum order quantity, price, and time of

delivery. The conceptual framework outlines the various components that underpin the ICT technology that paves way for an effective SCM practices. The Conceptual Framework and Theoretical Framework are presented in the following diagrams.

Conceptual Framework

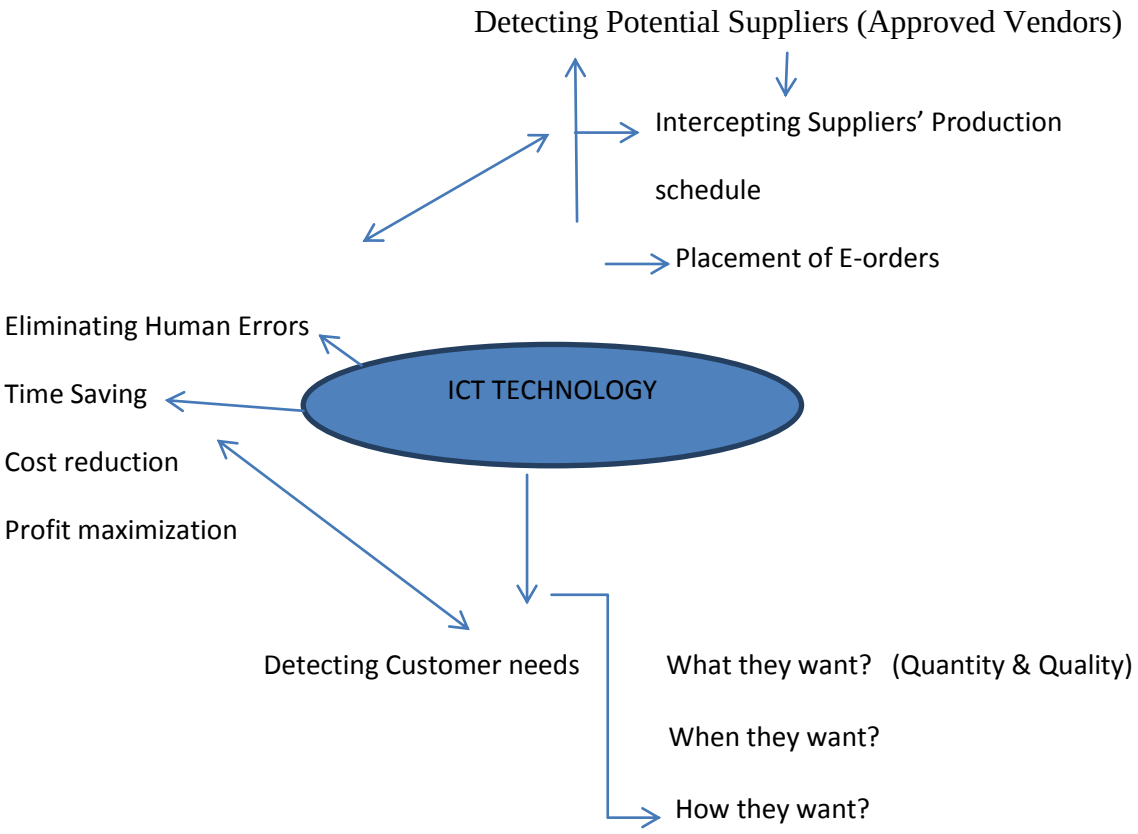


Figure 2.4 Conceptual Framework on ICT Applications

How the Conceptual work function:

With reference to the above conceptual diagram, there are number of crucial areas that firms have to pay attention in their SCM practices. In the placement of order stage, the 'Technological Capability' i.e. ICT based innovative technology for information sharing and processing helps the firms identify the potential suppliers using their supplier codes, the ability to supply (supplier capacity), the nature and the specific quantity of

materials, date and time for delivery , payment terms and other relevant matters.. This is made possible by special intercept programs known as ‘interface’ that is transparent to both parties. Likewise it is also possible for the suppliers to detect their needs of the firms i.e. what they want, when they want and at what quantity, price etc. well before an official order is placed. This proactive measures and interactions leads to mutual understanding between firms and other communicating parties can expedite the SCM chain and operations.

This in turn helps in the minimisation of human errors that are often seen in the manual operations. As the saving of time and the elimination of errors can safe cost and avoid time wastage leads to maximization of profits.

Linking SCM with technological capabilities: The Theoretical Framework.

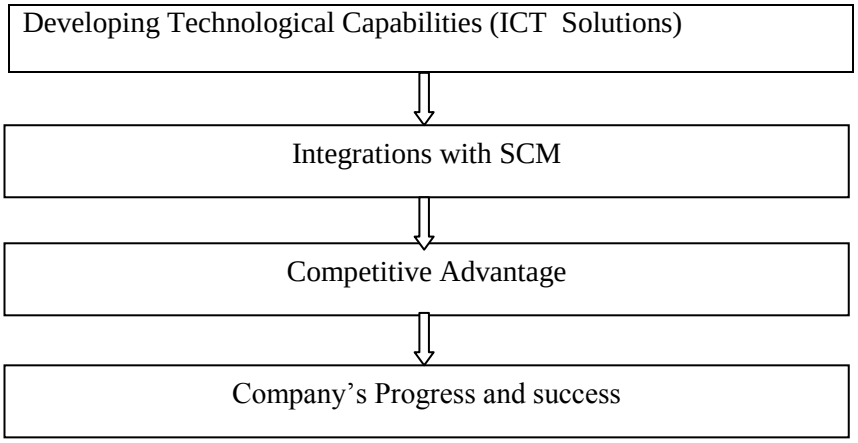


Figure 2.5 SCM with Technological Capabilities: A Framework

As shown in figure 2.5 the theoretical framework for the present study is divided into four stages. In the first stage firms develop their technological capabilities, especially in the ICT context that can help in the sharing and processing of information regarding pertinent business transactions. In the second stage this so called technological capabilities are applied in the context of SCM operations in particular where a bulk of crucial information is shared. In the third stage or phase , firms start to reap the benefits

of this technological capabilities that provides them with the competitive advantage over other players in the industry. Once these competitive advantages are optimized, firms can maximize their profits while leaving their rivals behind. This leads to the success of the firms as front runners in the industry giving them the upper hand.

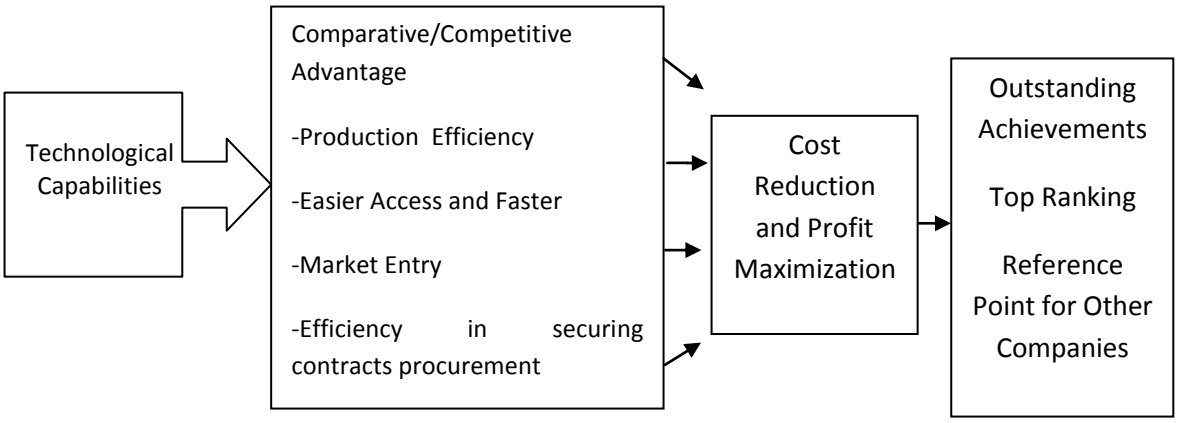


Figure 2.6 Technological Capabilities with Competitive Advantage: A Framework

As indicated in figure 2.6, the Technological Capability or rather the ICT innovative solutions allows the firms to gain competitive advantage over the others via a number of ways such as production efficiency, easier and faster market entry as well as rendering the edge in securing and winning potential contracts. As production increases along with productivity, there will be ample room for cost reduction and profit maximization. As such it would then be possible for the firm to achieve the organizational goals as industry leaders.

CHAPTER 3 RESEARCH METHODOLOGY

3.0 Introduction

As discussed in the literature review this study is focused on finding answers on queries whether technological capabilities (i.e. ICT based innovative software solutions for sharing and processing of information) determine the efficiency of supply chain management, and thereby contribute to the overall success of electronic manufacturing firms. This chapter reinstates the purpose and objectives of the study. It describes and justifies the research design, and the methodological approach chosen by the writer.

3.1 Chapter Outline

The first part of the chapter discusses the research paradigm providing justification for Qualitative Interviews applied in the study. The second part reinstates the purpose of the study, the sampling procedures and the selection of the interview questions.

3.2 Reinstatement of the Purpose of the Study

As stated in the first chapter this study endeavours to investigate the role of 'Technological Capabilities" (i.e. ICT based innovative software solutions for information sharing and processing) in the context of SCM operations. As argued in the literature, many modern firms resort to 'Technological Capabilities' in their niche areas to gain competitive advantage over their rivals in similar or homogeneous industries. In this respect literature evidence also claims that electronics industries in particular resort to a multitude of ICT based 'Technological Capabilities' to leverage their competitive advantage. In the light of this argument, the present study attempts to explore and capture the utilisation of Technological Capabilities, (i.e ICT based innovative software

solutions for sharing and processing of information) by an international electronics manufacturing firm in Malaysia.

3.3 Qualitative Research

The present study concerns as how 'Technological Capabilities' enhance the supply chain management strategies in the selected electronic firm that in turn makes it the front runner in the industry. As this study includes an exploratory element, it is suggested that a non-standardized qualitative research be used in the design (Cooper and Schindler, 2008). As an interpretivist epistemology is adopted, it helps the researcher understand the meaning that participants ascribe to various phenomena. Interviews may use words or ideas in a particular way, and the opportunity to probe these meanings will add significance and depth to the data obtained. Likewise they may also lead the discussion into areas that one had not previously considered but which are significant for the understanding and addressing of the research questions and objectives. Furthermore these types of interviews render each interviewee an opportunity to hear themselves talking about things that they may not have previously thought about. As such, the researcher is able to collect a rich and detailed set of data. However this might depend on the ability of the interviewer to interact with the interviewee (Silverman, 2007).

3.4 Justification for Qualitative Interviews

In the conduct of the research for this thesis, the writer used qualitative approach. As this is partially an exploratory study, in-depth interviews can be very helpful to 'find out what is happening, and to seek new insights' (Robson, 2002:pg.59). An interview is a purposeful discussion and can help to gather valid and reliable data that are relevant to the research questions and objectives.

In the pursuit of gathering data for this study, the writer used unstructured and open interviews with the selected personnel in the electronic firm chosen for the study. These interviews gave the writer a comprehensive picture on the role of Technology in the context of ICT based innovative solutions for the SCM process in the electronics industry concerned. Likewise interviews were also conducted with representatives of other electronics based firms that maintain customer-supplier relationship with the selected sample firm, i.e. Company X. The two (2) different categories of interviews had helped the writer to triangulate and validate the overall findings of the study.

Unstructured interviews are informal and used to explore in depth a general area of the investigation. These types of interviews provide the opportunity to talk freely about events, behaviour and beliefs in relation to the topic area. Moreover, these interviews can be regarded both informant interview and respondent interview. In an informant interview, it is the interviewee's perception that guides the conduct of the interview. In comparison, a participant or respondent interview is one where the interviewer directs the interview and the interviewee responds to the questions of the researcher (Easterby Smith et al. 2008; Ghauri and Grandhaug, 2005; Robson, 2002). As both of these approaches tend to use Non-standardized (semi-structured and in-depth) interviews in the data gathering process, a qualitative analysis is prescribed, for example as part of a case study strategy. The data concerned can be used not only to reveal and understand the 'what' and the 'how' but also place more emphasis on exploring the 'why'.

In order to obtain first-hand information, the writer made prior arrangements to interview the selected participants 'face to face'. The main reason for the choice of this form of interviews is that the writer can adapt the questions as necessary, clarify doubts and ensure that the responses are properly understood by repeating or rephrasing the

questions. The writer can also pick up ‘non-verbal cues’ and the ‘body language’ unconsciously exhibited by the respondent (Cavana et. al., 2001).

3.5 Reasons for a Case Study –Like Approach

In a case study, the CASE is the situation, individual, group, organization or whatever it is we are interested in. According to Robson (1999) Case Study is a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence.

A ‘Case Study like approach’ becomes necessary when we examine an unusual or an outstanding phenomena we often cannot generalize (Robson, 1999). Literature on electronic firms relates their failure to ineffective supply chain management practices. In the context of the present study , the chosen firm has been identified as a unique organization that has been consecrated to the development of technology especially in the context of ICT based innovative software solutions for information sharing and processing in the context of SCM practices.

According to Robson (1999) a case study is often regarded a *strategy*, i.e.a stance or approach, rather than a method, such as observation or interview. It is concerned with *research,* taken in a broad sense and including, for example evaluation. It is *empirical* in the sense of relying on the collection of evidence about what is going on. Finally it is focused on a *phenomenon in context*, typically in situations where the boundary between the phenomenon and its context is not clear.

In the light of the above it is the writer’s contention that a case-study like approach , like in the direction of the present study is suitable for exploring the link between ICT based innovative software solutions and the success of the SCM practices in electronic industries.

For the purpose of this study, data were collected from the three branches of a renowned electronic manufacturing firm in Malaysia. Two of the branches were located in the state of Johore, namely Johore Bahru and Senai, and the other in Kulim, Kedah.

3.6 The Sampling

We, as humans tend to make judgments about people, places and about every other aspect surrounding our lives on the basis of fragmentary evidence (Gall et al., 2003). Sampling is the process of selecting a number of individuals for a study in such a way that they represent the bigger picture or a larger group from which they are selected. As rightly argued by Gay and Airasian (2000), the purpose of sampling is to gain information about the population by using the sample. The degree to which the selected sample represents the population is the degree to which the research results are generalizable to the population.

In the endeavour to meet the objectives of the present study, the writer chose a prominent electronics manufacturing firm in Malaysia and used a 'case study' like approach to explore the interrelationship between the effective use of ICT technology and the success of the organization in gaining the competitive advantage. A series of different set of interviews were also conducted with representatives of other electronics firms that maintain customer-supplier relationship with the selected firm. Thus it is reinstated here that, the so called sample for the present study involves two categories of respondents. Firstly the SCM officials at the selected electronics firm (named as Company X) and the from representatives of partner firms that maintain customer-supplier relationship with the sample firm. A Case study in this context is a detailed intensive study of a unit, such as a corporation or a corporate division that stresses factors contributing to its success or failure.

3.7 Representative Sampling

Sampling considerations cut across all forms of enquiry and the stress in experimentation is on internal validity, rather than the demonstration of causal relationships (Robson, 2002). However, the exigencies of carrying out real world studies can mean that the requirements for representative sampling are indeed very difficult, if not impossible as sampling frames may be difficult to obtain. In other words the so called 'eligible' may not get into the sampling frame. This slippage s what Robson (2002) argues, 'between what we have and what we want' causes problems with representativeness and thereby possibly lowering the sample size.

In the context of this study which aimed to explore and establish the intrinsic relationship between technological capabilities and the success of manufacturing firms, the writer chose to adhere to **stratified random sampling** as the identifiable subgroups of elements within the population at the selected firm had different parameters on a variable of interest to the writer. The sample members drawn were both proportionate and disproportionate as there were variations in the number of senior level employees in the three sample locations.

In the light of the above and in line with the aims and objectives of the study, a small group consisting of fifteen (N=15) individuals were selected to form the sample. As the present study is fully qualitative in nature that used in-depth interviews, it is the contention of the writer that the sample size is adequate to yield the intended results. The respondents selected were senior level managers from the three branches of the selected electronic manufacturing firm located in the in three different locations in Malaysia, namely Kulim, Senai and Johore Bahru.

There is a corporate SCM in Kulim known as Global Sourcing Centre (GSC). I had approached the director and he helped me to contact all the 48 management staffs in these three location. They are Supply Chain Analyst (10 position at each location) Supply Chain Manager (3 position at each location) Supply Chain Senior Manager (2 position at each location) and Supply Chain Director (1 position at each location) and finally manage to interview 15 of them, which in turn consist 5 from each location.

As such the ratio combination of the three locations were selected as 3 (supply chain analysts): 1 (Supply Chain Senior Manager): 1 (Supply Chain Director) at each branch making a total of 15 participants.

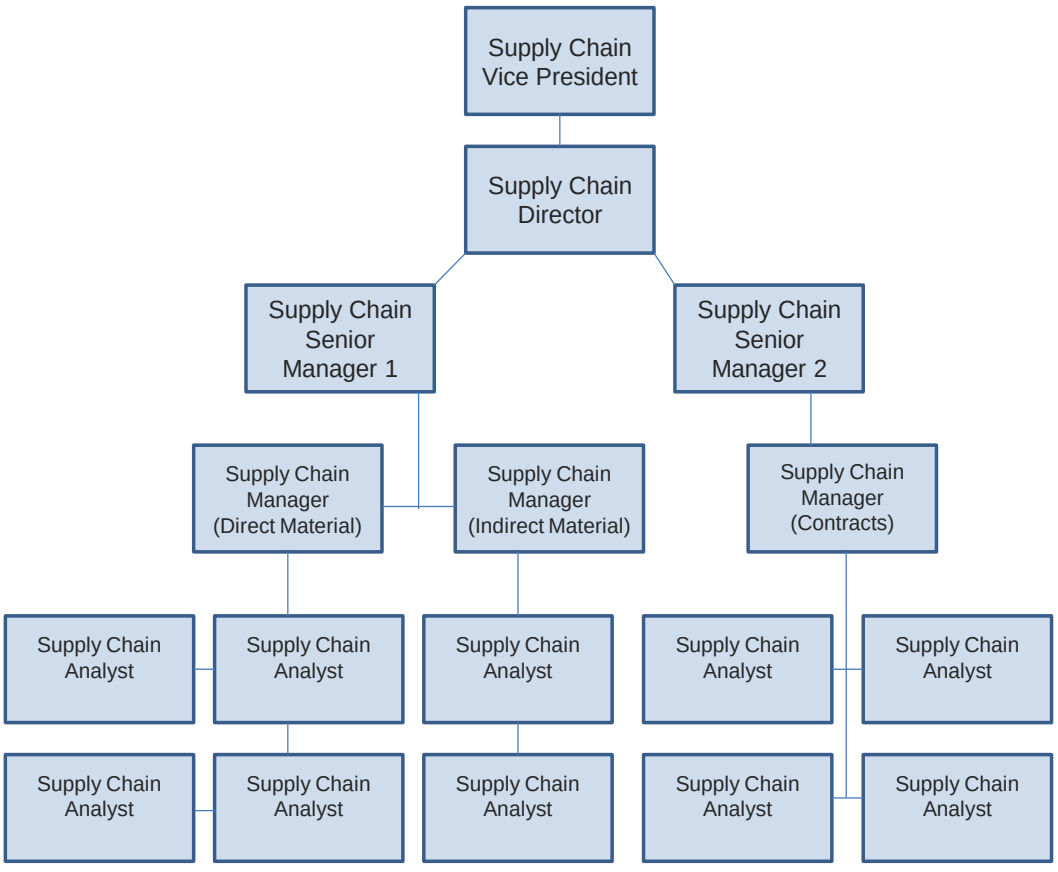


Figure 3.0 Executive Management Team Structure

The data collection for this Case Study was derived from two different sources. The primary data source was the SCM officials at the three branches of the sample firm. In the endeavour to triangulate the findings and to validate the information, the writer resorted to have interview sessions with some of the representatives of the partner firms in their capacity as suppliers and customers. The breakdown of the respondents who participated in the in depth interviews are as follow:

• 5 SCM officials • 5 SCM officials • 5 SCM officials Total: 15 (3 Supply Chain Analysts, 1 Supply Chain Senior Manager and 1 Supply Chain Director from each of the three branches.	• from Kulim, Kedah branch. • from Senai, Johore branch • from Johore Bahru, Johore branch Respondents were selected using mult-stage sampling process based on the existing ratio of the Supply Chain officials scattered at the three branches of the sample firm.
2 representatives 2 representatives 2 representatives Total: 6	1 from the supplier category and 1 from customer category for each firm. The representatives participated in the interview sessions under their capacity as directors in the SCM operations of their own companies.

Table 3.0 Interviewees Information

Purposive Sampling

Purposive sampling involves the choice of subjects (respondents) who are in the best position to provide the information required. It might sometimes become necessary to obtain information from specific target groups (Cavana et al.,2001). Here the sampling is confined to specific types of people who can provide the desired information, either because they are the only ones who possess it, or because they conform to some criteria set by the researcher.

In the context of the above a second set of sample respondents were deemed necessary for the purpose of triangulation and validations of the statements given by the SCM officials at the selected firm. These sample of people were identified via suggestions from the SCM officials and to some extent referrals from internet sources. The new subjects were selected based on recommendations and information provided by the initial subjects. This 'snow ball approach' (Cavana et al.,2001) method was used to locate members of 'rare' or 'private' populations.

3.8 Reasons for the Selection of an Electronic Firm

A very important industrial sector in many countries is said to be the electrical and electronics industry. Electronic manufacturing services (EMS) provide electronics manufacturing services for other companies. This industry is one of the sector that require supply chain management (SCM) to optimize the operations (Ai-Chin et al., 2010). According to Bowersox and Closs (1996) the electronics firms tend to utilize a very high level of technology and these industrial sectors is often noted as the heart of the high-technology industries. As far as the electronic manufacturing services industry is concerned, SCM is an integrated and process-orientated approach to the design, management and control of the supply, with the aim of producing value for the end

customer, by both improving customer services and lowering cost (Giannoccaro and Pontrandolfo, 2002; Bowersox and Closs, 1996). To bring down the rising costs and to keep up with the growing customer demands, many firms in the electronic industry implement some form of SCM (Dejule, 2007).

Due to the nature of the products, firms in the electronic industry face various hurdles. These include, among others, reducing the cost from suppliers, reducing product life cycles and addressing seasonal demand (Carbone, 2005). This expectation requires a high concentration on the supply chain consistency since the highest variable costs involved is the raw material used. Other than negotiating the price of the raw materials, there are other means that can be managed efficiently towards making a huge difference or reduction in cost thereby bringing about an increase in profits. As such SCM responsiveness in vey vital in the electronic industry which in other words help keep up with the innovation and the time-sensitiveness of goods produced by the industry (Carbone, 2005).

3.9 Reasons For the Choice of The Sample Firm

The selected firm is a multinational electronics manufacturing services (EMS company headquartered in Toronto, Canada. The firm's global manufacturing network comprises more than 40 locations in 11 countries in the Americas, Europe and Asia, wide variety of leading OEMs (original equipment manufacturers). In addition to manufacturing, the company's global services include design and engineering, systems assembly fulfillment and after-market services.

According to the Year Book, Celestica (2011) it has the highest manufacturing output with the lowest headcount for the capacity accommodated compared with any other divisions of the business. It is efficient in terms of its capacity utilization. It has a

consistent manufacturing planning without much down time. It uses Just in Time inventory management via suppliers from Japan, Taiwan & China. It has a highly skilled manpower. Last, but not least it has high speed customer demand fulfillment comparatively to other businesses in the industry.

3.10 Reasons for Concealing the Identity of the Sample Company

Robinson (1991) argues that confidentiality is the cornerstone of social research encounters, particularly because of the protection it offers for informants. In this research paper, the writer presents one of the key ethical features of research: confidentiality as maintained by nondisclosure of participants' identities. In light of (a) the contingency that certain participants might vest interest in research studies through their identity and (b) the concept of respect for participants' autonomy, the writer considers the possibilities of offering research participants the choice of non-confidentiality, afforded as an autonomous (negative) right of refusal of nondisclosure of identity.

One of the key issues in the ethical conduct of research is the confidentiality both of participants' identities and of the findings gained. In general, researchers are obligated to protect the identity of their research participants (Ryen, 2004) and ensure that the parameters of such protection are fully explained before the research begins (Rae & Sullivan, 2003). By definition, confidentiality refers to information that has been communicated in trust of confidence, such that disclosure would or could incur particular prejudice they choose, (b) the concept that secrets can be shared as each person chooses, and (c) the understanding that the promise of confidentiality is binding but must also acknowledge each person's desire and right to share information (Bok, 1983). Often, participant anonymity is the mechanism through which privacy and

confidentiality are maintained, but although this affords protection of identity, it might also foster particular ethical and pragmatic concerns.

In the light of the above it is important to bear in mind that research remains a moral enterprise. In examining the potential conflicts of participants' and researchers' autonomy, we must remember that researchers must regard participants as ends unto themselves and not merely as means. Therefore, researchers must respect the choices of participants but must also recognize the obligation, as stewards of knowledge, to conduct research in ways that are ethically sound both to individual participants and as a viable public good. As such, research must be conducted in ways that are consistent with and sustaining to its scientific and moral ends. Thus, although certain options might be available to allow participants particular latitude in participatory choices (e.g., use of pseudonyms (Grinyer, 2001), the practicality and ethical value of each must be considered carefully.

When making official approach to obtain the consent from the sample firm, the authorities at the sample firm concerned have clearly expressed their concern over security and confidentiality issues. They made it a point that the writer never reveals the identity of the sample firm. Thus, this requirement on the part of the selected sample firm became an unavoidable ethical constraint on the part of the writer. Infect they requested for a copy of the research report to ensure that their request is not breached. Having to adhere to ethical guidance and rules, the writer chose to conceal the identity of the selected firm. For the purpose of report writing the Kulim based firm is referred as Company X.

3.11 Concluding Comments

This Chapter (3) reinstated the purpose of the present study, i.e investigating the technological capabilities (ICT based innovative software solutions for sharing and processing of information. In the first part the reasons for a qualitative paradigm was established together with interviews as the selected tool for data gathering. It then talked about the sample and the sampling procedure. The final part of the section dealt with the reasons for the choice of an electronic firm and the reasons for the choice of the selected firm in the Malaysian context and its brief background and structure.

It is the contention of the writer that it is important for the reader(s) understands the reasons and justifications of the research design in terms of its paradigm and aspects pertaining sample and sampling. Likewise it is also important for them to have a brief view on the background facts of the chosen firm in making up the meaning in this study.

CHAPTER 4 THE FINDINGS AND DISCUSSION

4.0 Introduction

The purpose of this research paper is to highlight the role of the technological capabilities (ICT based innovative software solutions for the sharing and processing of information) in an electronics manufacturing firm with its branches spread across the three geographical locations in peninsular Malaysia, namely, Kulim, Senai and Johore Bahru. The roles of technological capabilities were explored in the context of the supply chain management. In this respect, the perspectives of the senior level managers were obtained through in-depth interviews. Via in-depth and open interviews with some of the personnel at a senior level managerial positions at three of the branches (please see appendixe A and B) , this study investigated as how the effective use of technological capabilities (ICT based innovative software solutions for the purpose of information sharing and processing) helped to facilitate SCM processes. Likewise another series of interviews, i.e. six (6) interview sessions were conducted with selected representatives of partner firms who maintain customer-supplier relationships with the main sample firm. The results of the interview sessions were matched with the findings of the interviews with the SCM personnel of Company X to draw conclusions.

4.1 Chapter Outline

The chapter begins with the purpose of the study, investigating as how electronics manufacturing firms utilize technological capabilities (ICT based innovative software solutions for information sharing and processing) especially in the context of their Supply Chain Management Processes. In other words the chapter deals with information on how the sample electronic firm concerned makes use of its 'technological capabilities' as stated in the above contexts in terms of its advanced ITC based innovative software programs.

The data description was derived from the in-depth interviews conducted with senior level managers in the three branch organizations. The second part of the chapter discusses the findings in the context of the literature on technical capabilities in supply chain management. For the convenience of the reader the high lights of the interviews are incorporated within the discussion text. The points of discussion in this chapter are highly technical. As this chapter is based on qualitative data derived from in-depth interviews, the analysis and interpretation part was done according to the suggestions given by Miles and Huberman (1994), i.e. data reduction data display and drawing conclusions. In the analysis proper, Content Analysis was used to analyse data. Via the analysis process, the writer identified themes and patterns in the interview data.

To ensure that the writer has understood the explanations given by the managers, and to ensure that 'their voices' are interpreted correctly, it might be crucial to mention here that the writer verified the following text portions with the respective respondents at the three branches of the electronic manufacturing firms. The chapter ends with the summary of the key findings.

The findings are presented in sequence. As mentioned the interview sessions focused on 'how technological capabilities' helped or facilitated SCM operations in the three branch organizations. The managers interviewed in all the three branches agreed unanimously that technological capabilities are the focal point in their successful operation. The branch organizations reportedly exploit ICT facilities to their maximum advantage in a multitude of ways. However, the managers chose to emphasize or were rather willing to reveal only some of the key aspect of the technological capabilities. (ICT based innovative software solutions for information sharing and processing). According to the officials interviewed the effective usage of 'Technological Capabilities' are concentrated in the following contexts:

a) Data Base

b) Communication

c) Planning, Scheduling And Forecasting

d) Tracking And Monitoring

e) Interface With Customers And Other Stakeholders

f) Evaluation And Reporting.

4.1.1 Data Base

Data base basically assists in the storage and dissemination of information. By virtue of the nature of the electronic industry, the company operations deal with thousands of electronic components and parts. As one manager expressed:

"It is not humanly possible to remember or get easy access to the wealth of information on components available in the electronic industry. Browsing for quick and timely information is only possible with comprehensive IT data base such as ours"

The data base is also useful in securing information on potential buyers and suppliers as well as information leading to current and previous business transactions across the globe (please see appendix F). Accessibility to such information helps in the decision making process in SCM. As how well this helps in the SCM process, one manager said:

"In manual processing such as purchase orders, transaction receipts, etc may be subject to human error, leading to misplacements, or get lost or may be overlooked in terms of payments. The data base concept eliminates all these problems"

Furthermore the data base system allows the organization to make comparison on quotations between suppliers on a particular product, component or raw materials. In answering as how firms may be able to compare the quotations via a technological tool (please see appendix D), one manager said:

"Well! This is being done using the *Total Cost of Ownership* tool (TCOO). This tool helps in the screening and selection of suppliers that provides the best possible deal. It has the capacity to compare and contrast some of the key aspects such as lowest price with shortest lead time and minimum order quantity (MOQ) with longest payment terms among potential suppliers"

Emphasizing on this point he further reiterated that:

"Comparison of prices between suppliers, and negotiating terms with them is a tedious process and this means a lot of time consumption and unnecessary delays in the process. In international business operations such as ours, time is a serious consideration. Delays not only lead to cost overrun but it affects our reputation too!"

In some instances product components may have been replaced, undergone modification or have been changed altogether or become obsolete. The data base facility also provides records of these operations. This information is deemed crucial for new referencing and training of staff in the SCM operations and purchasing the right tool is another area that requires skills in making the right tool however it is supported via Decision Support System (DSS) please refer appendix G. In this respect one manager remarked:

"The customization of this tool enables us to run the changes by what we call project number and customer or commodity group, for example with reference to a particular buyer, planner, by location and also by date. These are some of the added advantages we enjoy.., all these are made possible because it is embedded in the technological system network!"

4.1.2 Communication

Another interesting or rather an essential point was that the three branch organizations also enjoy a wealth of information received from their Indian counterpart in Hyderabad which acts as a 'central nervous system' for the dissemination of information. This according to the managers is made possible by virtue of the presence of abundant IT trained personnel in the said Indian branch.

Likewise in line with globalization, the firm concerned also works with an international procurement centre (IPC), based in Switzerland. This centre acts as a central body or separate business organization that combines the total demands of materials from all member firms. With the multitude of network and systems within systems the firm concerned also acts as a source of information for their numerous customers and suppliers across the global environment. In other words the firms act as advisory units for other companies on information leading to the availability of quality products, and indicate to them the right time for the purchase.

The leveraging of information technology and the successful improvement of channel process efficiency has enabled the sample electronics firm to reach higher financial goals. In this respect one manager said:

"Now we are selling our goods at a much quicker rate as soon as they are out of the factory and before we even pay our suppliers. Isn't this wonderful? This has been made possible by sharing information and executing a technological system called ERP (Enterprise Resource Planning)"

It was noted that the ability to receive payments from customers for its products before having to pay their suppliers, that is, achieving negative "cash-to- cash cycle items" places the firm concerned in the same league with renowned companies having the most efficient supply chains.

Beside the use of the ERP, the managers also mentioned of another important technological system that is pertinent in our discussion on modern SCM. According to one of the managers:

"The role of technology was to link the supply chain by using industry standards Electronics Data Interchange (EDI) to communicate key business documents. Purchase orders, invoices, advanced shipment notification, and financial payment are just a few examples of the transmission of EDI"

With their technological capabilities, the three branch firms had also developed a billing accuracy system that was used to measure how accurate their invoices were, against their customers' purchase orders. If the invoices matched, the parties concerned will be paid automatically. The firm believes that 95% of the invoices were accurate and so far there were no issues with billing or the receipt of early payments. In elaborating the numerous benefits of technological capabilities, one manager recalled and emphasized the use of another vital tool that smoothen the SCM process. He said:

"Technology also plays a role in identifying and correcting pricing errors. This tool in fact is a built-in device called the *customer table checking tool*. Before any purchase orders were created, we link or log on into our *customer firms' item file of products*, and compared them to the pricing and product specifications. If the items do not match, then the products were flagged as an exception and electronically corrected".

This is to say that the customer service organization ensured the data in both systems, i.e. the one at the firm's end and the other at the customer firm's end. Via this technological system there is check and balance in the pricing of products or component materials that are crucial for negotiations. As such the EDI is said to drive down costs and improve the order cycle time.

4.1.3 Planning, Scheduling and Forecasting

In line with the purpose of the chapter, this sub section highlights the use of IT technology in the scheduling and planning of SCM operations. In a particular project, the supply of different components may involve different lead time. The knowledge on time awaited for the procurement of supplies from various sources is a crucial factor that might determine the efficiency of a firm. If the firm were to be in the dark about when a particular supply will arrive, there might be a lot of time wastage pending production and this might affect the overall operation of the firm leading to heavy losses.

4.1.4 Tracking and Monitoring

With the help of information on the accuracy of lead lime for the procurement of various parts and components, the firm can plan and schedule its work operations accordingly. In this respect, one manager said:

"With customized IT assistance, it is easy for us to monitor the exact location of the goods or products that is in transit and the exact time of delivery. As such we not only can schedule our operations, but produce and deliver the goods to our respective customers in time".

Adding to the above information another manager said:

"The customized IT system will enable one to have access to information on various project information such as the particulars of the project owners, the locations, their associates and affiliates, operation schedule etc. The convenience of accessing this information is a great advantage because it helps in the monitoring of business operations and the SCM processes of all pertaining industries across the globe".

4.1.5 Interface with Customers and Other Stake Holders

One of the customized IT tool known as *'scavenger'* (used figuratively) is well linked to all IT systems within the industry, the various stakeholders as well as all those involved in the SCM operations. This unique technological system has the capability to pool information up to the 'history' of the single component. In describing the functional aspect of this essential tool, one manager said:

"Any component or mechanical part purchased by our firm is assigned with internal part number which ends with designated codes that indicate the customer. This internal code enables us to review the entire transaction from Customer Bill of Material (BOM) into transformation of finished product, in great detail. By accessing a single part number, we may be exposed to how it travels or subjected to various processes. This is important to measure the efficiency and speed of manufacturing".

In the mean time a system called New Parts Sourcing (NPS) is used to send auto notification to the various suppliers immediately, after the 'explosion of BOM' (revealing of information) by the Matrix Team, manned by group of engineering personnel. The NPS system is also programmed to assist buyers to update the parts information into yet another system called, System Applications and Products (SAP). This in turn will help generate Purchase Order (PO) via a system of transmission called Electronic Data Interchange (EDI) (discussed earlier) direct to the suppliers. In this respect one manager said:

"Prior to this activity, buyers obtain the BOM information on manufacturing part number, the Approved Vendor List (AVL) and the estimated quantity. A system called Quote Win (QW) is then used to send out Request for Quote (RFQ) and other details of transactions such as minimum order quantity, shipment and payment terms".

This notification is based on the project estimated quantity stipulated in the BOM and the estimated time and date of production. This will serve as an assurance that all the notified suppliers are ready to cope with the demand for the materials concerned.

It was also interesting to learn that, the parent company of the firm in discussion has opened an Internal Procurement Company (IPC) in Switzerland as part of its organizational and managerial innovation. This company acts as a purchasing unit on behalf of all their international branches. The IT system known as CMUPLOAD enables IPC to run a report via Manufacturing Part Number (MPN) in order to monitor the global requirement. In explaining the role of MPN in the supply chain process the manager said:

"The MPN is unique and specific to every individual manufacturer and it is widely used by all distributors, brokers and resellers. The compilation of MPN which signify the global demand is then used for the purchase of materials in bulk. This strategy not only helps to lower the cost but trigger the identification and destination of delivery"

Most of the firm's business transactions with suppliers and customers were conducted via IT transactions. EDI, XML or extranet solutions were typically used for the processing of orders and invoices in the companies. In some cases, IT was also used to process delivery verifications and dispatch advices. As such reduction of manual work and costs, improvement of information quality, speeding up of information transfer, and volume of transactions were found to drive the use of IT for transaction processing. As to how the firm concerned acquired this technology, one manager explained:

'This is due to the development of wide IT network system. This network facilitates the collaboration with suppliers in Supply Chain management. As most suppliers use a

specific system, they insist on transactions done via their systems in order to avoid manual entries and harass. As such our firm has to give in to the needs of the suppliers' system to enable smoother bilateral advantage".

In explaining as how this system actually works, he added:

'With the IT network system and its specific technological capabilities it is possible for us to have 'visibility access' to suppliers' materials. In other words we can know what is available, when they are available, the quantity available and time for earliest shipment".

When asked if it is possible for anyone to have access to this information, the manager answered:

"No! Each potential purchaser has to have a web code (XILINX) and a password to access the suppliers' inventory system. Likewise, in a similar manner the suppliers can also have access to our system. As such suppliers will know what is required by us, at what quantity with quality specifications and time of requirement etc. This two-way interaction provides positive and productive collaboration that helps to reduce time wastage, human error and harass. So, you see! Obviously this method helps to save cost, and we would be able to cater for the needs of our customers at a much cheaper price. These provide a competitive advantage over our business rivals in terms of customer retention ensuring a steady profit throughout"

In order to facilitate these, both companies must have the necessary system to 'interact'. This so called interaction is made possible by technological capabilities in the context of vast global IT network enhanced by the internet tool. As a result many aspects that are intrinsic for potential business transactions between engaged parties such as pricing,

stock, minimum order quantity (MOQ), lead time, technical specification details and material safety data can be conveniently exchanged.

This collaboration is made possible by the vast network of technological capabilities. The pooling of the demands from a one central point help provides the member firms a multitude of advantages. For example it is possible to get access to big time suppliers who may only accept a minimal order quantity; secondly the high quantity of purchase helps to come down with low prices with volume discounts; shortest lead time, longest payment term and supplier managed inventory to reduce losses. Moreover it also reduces carrying cost, insurance and warehousing cost. As this method of central procurement helps to reduce the variable cost, it automatically increases the net profit shared by the member firms.

4.1.6 Evaluation and Reporting

Evaluation of work-in- progress is an integral aspect of any management system. As the sample firms heavily rely on technological capabilities, the evaluation of their own success is also made possible by technological means. The evaluation reports and the timely response communication by all parties concerned helps the organizations rectify potential issues and flaws at a speedier rate. However, none of the managers revealed as how this procedures are conducted. In the views of one manager interviewed :

“Many resources useful for technology planning are also useful for evaluating technology implementation efforts. The evaluation is rooted in an examination of our plan's vision and goals for technology!”

The following diagram summarizes as how the three branch firms concerned exploit their technological capabilities in their SCM operations. As per the above discussions the following diagram signifies the advantages in the context of Data base, communication, planning, scheduling and forecasting, tracking and monitoring as well as in evaluation and reporting techniques via its technological capabilities. This in turn gives the firms the added or competitive advantage over the front runners in the electronics industry.

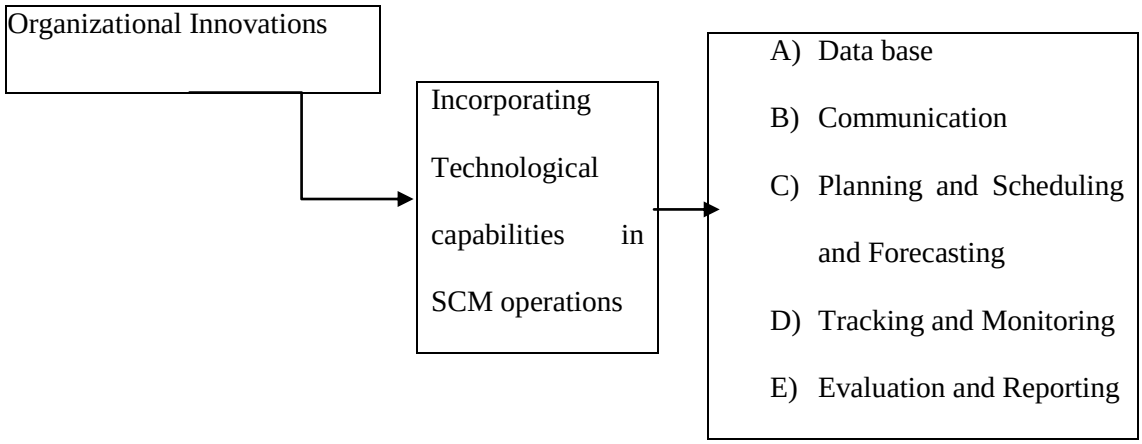


Figure 4.1 Lists of Organizational Innovations

As shown in the above diagram the organization concerned comes up with innovative solutions in the form of ICT based technological capabilities (software solutions for information sharing and processing) especially in the context of SCM operations and practices.

The innovative software helps the firm concerned in a multitude of ways such as maintaining an effective inventory system, as well as a strong data base on customer information and contact particulars. Secondly the software concerned facilitates the

flow of information, infringing all the hurdles of possible human errors and thereby enhancing effective communication within the firms business network. This innovative software solutions also help in the various stages of the SCM operations such as tracking and monitoring of products while they are in the threshold or in transaction. Last but not least, the software also helps in the overall operations and functions of the firms in terms of evaluation and reporting.

Discussion

From the findings of the study it is apparent that with increasing competitive pressure, many leading firms and organizations are motivated to establish their competitive advantage (Dae Kim, 2010) by optimizing their internal and external processes throughout their supply chain. The effective use of technological capabilities especially in the context of supply chain management by firms in the study match the literature on technological capabilities in the SCM practice by (Sanyal and Guha, 2010). Aspects pertaining to the use of IT technology in the SCM process and organizational success (Jitpaiboon, 2005) especially in the Malaysian and Brazilian context (Ai-Chin et al. 2010) matched the findings of the study in the contexts of material flows management and the facilitating of interactive and strategic alliances.

The analysis of the interviews reveals that there are two types of driving forces found to be embedded in the process that enhanced the SCM operations in the three branches. The first one attests to Customers and the other one being motivated or triggered by the rival groups (competitors) in the industry.

Customer Driven:

The IT network system within the SCM enables all customers of the firms to have access their production plan. This gives the customers a great advantage in a sense that they can plan and ensure their own supply to their very own customers. Furthermore this 'transparency' helps the customers to oversee and understand problems pertaining production issues such as the likely time delay and/or other quality issues. The technological capabilities enhances speed of response by all interacting parties in the system, it reduces operation cost, eliminates red tapes, increases efficiency and fosters new product entry.

Competitor Driven:

The continuous development of technological capabilities, especially in the SCM operations of the firms concerned is driven by competition from their rival groups. This signifies the need for a benchmark technology with competitors. In retrospective, this helps the firms to gain trust from the customers because the firm concerned is said to be in par with other producers and suppliers. As such there is an internal drive to build competitive advantage and to create a mechanism that benefits the most towards customers in comparison to others. From the financial side it also helps to reduce operation costs and to eliminate wastage. Last but not least it also reduces the down time (delay) and to expedite delivery and to improve turn- around time.

The findings of this study provide support to the proposed relationship between the drivers and the use of ICT innovative softwares for transaction processing. Support was also found to the expected drivers for the use of ICT innovative softwares for order tracking and delivery coordination. The analysis of the drivers for the use of ICT innovative software for supply chain planning and collaboration, is tightly linked to the development of respective cross-organizational processes.

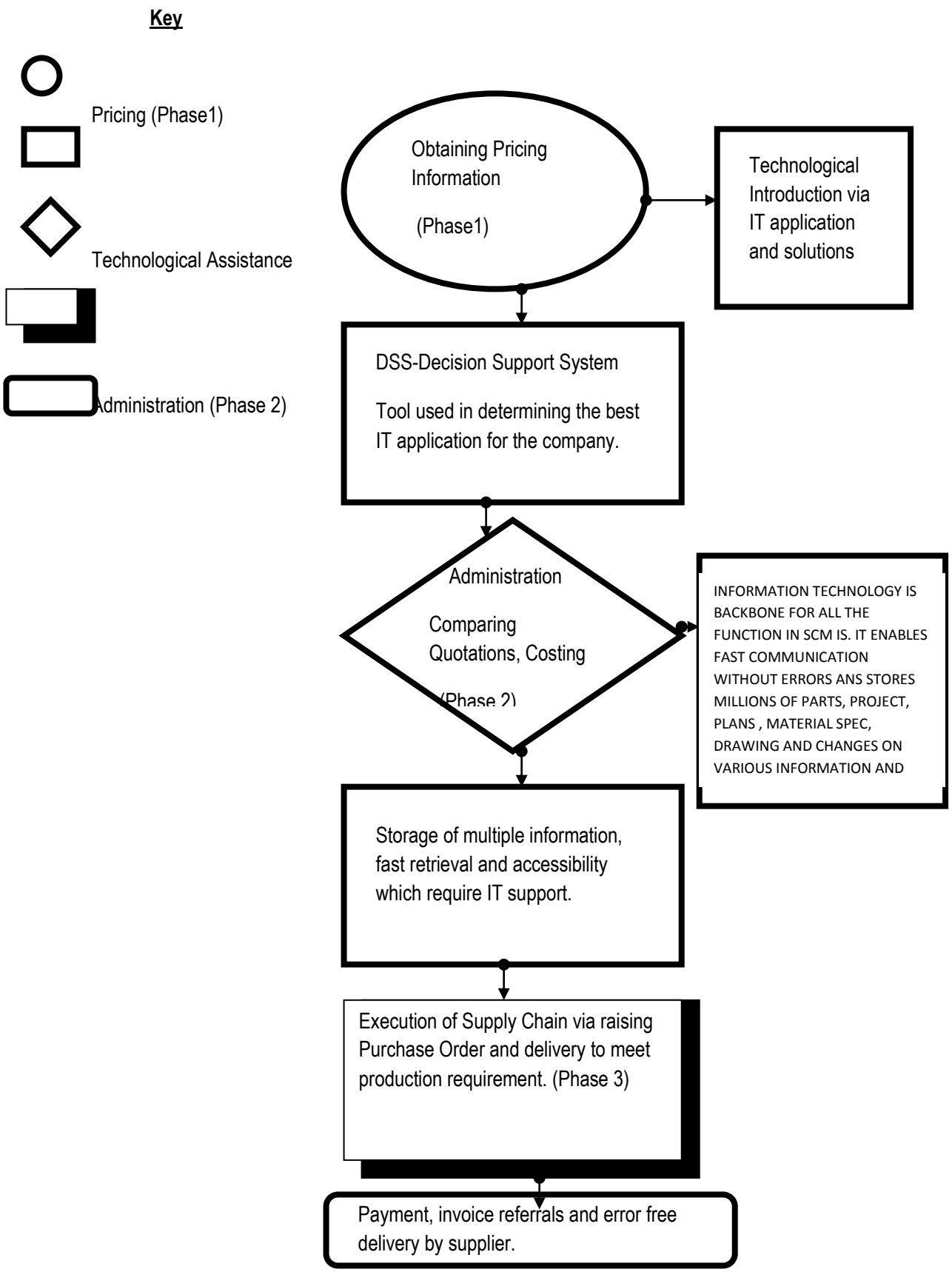


Figure 4.2 Technological Advancement in Supply Chain Execution

As the outcome of the interview with the officers who were directly concerned with the SCM endeavour, details on how the SCM utilizes the ICT based technology were obtained. The final report on this (which marks one of the cruxes of the study) was duly verified by the officers concerned several days after the interview. This means the writer had to revisit the three locations of the firm branches in order to validate the information. This was crucial as the subject matter was highly technical and there might be an element of ambiguity in the material cited due to weaknesses on the part of the writer. Although it was a tedious process having to 'disturb' the respondents concerned once again, the writer have the contention that he managed to gather the relevant information pertinent to the study.

This study is concerned with as how the selected electronic industry exploits sophisticated IT technology especially in the context of its SCM practices. The process is explained briefly with the illustration of the above diagram. The process as how ICT innovative solutions help in the management of SCM practices is presented via three phases namely (i) Obtaining Pricing Information (Phase 1) (ii) Administration Comparing Quotations and Costing (Phase 2) (iii) Execution of Supply Chain via raising Purchase Order and delivery to meet production requirement. (Phase 3).

4.2 Obtaining Pricing Information (Phase 1)

In phase 1, the studied organization or the company under investigation is a contract manufacturing company that runs assembly facilities. The nature of the business is assembling electronic component parts into printed circuit board as per the requirement of customers from various parts of the world. As such the organization concerned is a contract manufacturing company which obtains its mandate to manufacture after winning the bidding process. In this respect a customer provides the Bill of Material (BOM) and is technically 'breached' using a system called MATRIX. The BOM contains information such as the board name, project name, the functions of a board, components required to assemble the board, list of suppliers for those components, specifications, drawings and guidelines on other manufacturing processes. Therefore it is very crucial to breach the BOM properly and furnish all the information to the correct owners to execute the 'build plan'. In this respect the role of ICT based innovative software technology is very crucial and can never be challenged. Prior to the implementation of a strong ICT innovative software packages and their sophisticated tools, the studied company has been facing tremendous problems in managing the information sources and redirecting them to the right department and executing the needful changes to achieve the desired results.

During the bidding process to win a project contract manufacturing companies such as the one under current investigation requires pricing information on the components. This component is deemed the raw materials and holds the biggest portion of variable cost compared to other costs which are more standardized and fixed. Therefore obtaining the cost for the components on time is very essential and crucial. Before implementation of Quote -win , quotation were obtained manually and keyed in into an excel file manually that are prone or subjected to human errors. The extra costs incurred

due to the wrong pricing of components and the resulting costs were borne by the respective contract companies.

Besides the following up process for quotation for number of projects can be a tedious one. Sending of drawings, specifications and codes for component parts numbers via email and other manual processes such as having to call the suppliers by telephone etc., was costing a lot of expenses, man power and resulted in time wastage.

With the advent innovative software solutions such as Quote –Win, the firm concerned are now able to send out notification to suppliers with a requested quote that complies with all the required specifications together with dates and reference numbers. Each supplier is given an ID and password link to a website that has all the drawings, specifications, and part numbers. Suppliers are required to key in the price and other relevant information and are responsible for the outcome. Once the supplier 'hits the SAVE', the information will be pulled into the Quote-Win system. As such purchasing officers will be able to 'see' the pricing quoted by suppliers without any wrong assumptions. These eliminates likely human errors and saves a considerable amount of time and money. The Quote-Win system is also programmed to enable manual key in for those suppliers who currently do not have an access to the system-wise pricing information. As such purchasing officers are able to differentiate easily between manual key -in and supplier web quoting.

4.3 Administration Comparing Quotations and Costing (Phase 2)

The Billing of Materials (BOM) given by customer are breached using a system called MATRIX. MATRIX has the capability to redirect particular information to the right system with the chain accurately via secondary database. This and alerts the administrator if there were instances where the transactions get failed. For example, a component that uses 'manufacture - part –number' is assigned automatically by a system called ASPECT. This system stores other related information about this part, such as the validated vendor, the description of the part, commodity group, date created, project name meant for the use of the purchasing team. ASPECT has eliminated problems faced by the studied company, especially in tracing a part number and other information within matter of seconds and the information stored has 100% accuracy rate. This is made possible as it comes directly from BOM and not subjected to any human errors during the course of the transaction of information from customer to the studied company systems.

Moreover MATRIX stores information about drawings, changes, amendments or modifications made in manufacturing part numbers due to obsolesce (discontinued), vendor changes and or any other changes due to quality or customer request. Every changes in the drawing and specification approved by supplier via MATRIX will is also accessible to customers via ID and password. Prior to the usage of MATRIX, the studied company experienced somewhat a 'haywire' situation with the manual traceability and approval issues. Furthermore most of the time that information was not managed properly and tracing the history was indeed a hassle. Effort to retrieve, and the approval via email was even tougher as traceability via both measures was not synchronized. Hence change requests were raised manually via email and the drawings were then kept in shared folders bearing project names. In the past there were reported

evidence of missing files, and usage of non –latest version of drawings had caused a lot of financial losses. With MATRIX each and every deletion or add up changes are recorded, and hence approval standards and their traceability are reported to be very good.

The MATRIX that is in use today would not have been satisfactory or perfection without setbacks or flaws without the internal ICT specialist touch. From time to time they further improve the system and correct the discrepancies and disadvantages. The Aspect Data Correction Request (ADCR) system is part of the MATRIX tool used in the studied company. Via the Matrix system a user is able to issue the ADCR tool by providing a change of information for the obsolete Approved Vendor List (AVL) and the removal of existing AVLs, Part Number Change (PNC), Drawings Update (DU), Revision Update (RU)(from old to new), Non OSHA Compliance, Suffix change, Tape and Reel extension to the production and the company network system worldwide. If a component is said to be 'On Hold', the ADCR tool is able to provide information or reasons for the component that is On Hold. The system is also able to state the Time and Date along with the Reasons for 'Hold' and Engineers responsible for the verification of the said Component to the supplier. This allows the Product Engineer to go back to customers by resolving the AVL issue which is pending in ADCR system. This reduces all internal problems and eliminates external issues between the firms providing an excellent Customer Service. In a nutshell the ADCR (Aspect Data Correction Request) system is a part of the Data Bank that provides software solution to help update the AVL (Approved Vendor List) of the Component and Supplier Management (CSM).

The ADCR tool enables the firms to streamline and automate the part number setup and help the release process. This helps to accommodate the organization's aggressive schedules and demands of deployment. The ADCR tool is able to provide services

which enable the rapid search, do the necessary comparisons, or helps in the selection process by consolidating the optimal components. The tool also able to automate the setup of the suppliers AVL and Part Number, and facilitate the automation of requisition, procurement and design processes. Thus the ADCR system is able to generate a systematic data management solution and provide a history of the components available or used by the firm.

The possession of ADCR tool has helped the firm under investigation to develop a better procurement sources via SCM, Engineering and Design Teams. This in turn has perceived to have brought the organization as part of the best data management systems in the world of Electrical & Electronic Industry, lifting its status as one of the fastest customer service and solution provider.

4.4 Execution of Supply Chain via raising Purchase Order and delivery to meet production requirement. (Phase 3)

In this phase, SCMDW and SAP system has been customized to best suit the needs of the studied company. SCMDW is tailored fully by internal IT teams while SAP is deemed a standard application that has been customized. Before the development of SCMDW the same components were purchased from various 'Build Site' companies which has resulted in higher cost, and minimum order quantity (MOQ) although the usage was comparatively minimal. This has created 'a white elephant scenario' for the firm where the same manufacturing part number existed in all the global Build Sites because each build site managed the inventory separately and manually.

Introduction of SCMDW has eliminated multiple purchasing of the same component for various customers because SCMDW can now 'view' the global demand for the next three to six months. Needless to say that the introduction of SCMDW has eliminated

much of the firm's carrying cost, transportation and insurance cost. It has also helped to secure the global demand for an order with the lowest price and easy management of components. This means the available stock can now be moved from one site to another easily without having to buy it again. Another advantageous factor is that the SCMDW system has been conveniently linked to other system and data applications such as ASPECT, MATRIX and SAP. This in turn can trace, secure and provide other information which allow other purchasing teams to issue Purchase Order (PO) for components which are due for orders in accordance with the lead time. Failing to raise Purchase Order on time will cause serious delays in production planning and thus firms concerned may be unable to meet customer orders on time.

As SCMDW system is linked to the Sales and Purchase Agreement (SAP) the system screen will 'highlight' the Purchasing Order (PO) number for all the components orders. Likewise for those 'not ordered' or 'not acknowledged' or those that do not suffice or meet the expectations by the recipients will appear in RED to differentiate the situation. The SCMDW also assists in the reflection of other pertinent details such as production planning details, the planner, production manager, the buyer and the facilities involved in the project concerned along with the manufacturing part number, project name, planner name, buyer name or by any search criteria that may ease the traceability.

Customization of SAP by local IT team ensures the standard IT tool now best suits the studied company's requirement. SAP is now able to store purchase order information along with pricing information. It automatically updates details such as price information, payment term, minimum order quantity and shipping term from Quote-Win, which a normal or standard SAP will not be able to provide.

Any deleting, discarding or change made is captured or registered via ID of the user which enables traceability. Without having this 'history' in place, changes of price or even the source of supplier itself will cause issues especially if the validated vendor not available in the customers list meant for (BOM). As such the studied company's SAP itself would be able 'to talk' to ASPECT to eliminate or minimize unnecessary issues that may arise in his context. Most importantly unethical practices among purchasing team, such as choosing their preferred supplier is eliminated. SAP will generate weekly report that provides evidence on any manual change of supplier not found or recognized by ASPECT. Purchase order created by SAP to supplier will also have all the information such as shipping terms, payment terms, component description which all the information from ASPECT,MATRIX and Quote- Win via secondary database.

At this juncture it is vital to mention here that, the availability of sophisticated IT technology alone does not contribute to its progress and success. What may be more important here is the availability of well- trained IT savvy personnel or engineers who are involved in the production and operationalization of the technology.

4.5 How the firm has built its Technological Capabilities

Apparently the selected firm places a lot of emphasis on Research and Development not only in the context of product improvement and innovation but ways to improve its technological capabilities as well. To date more than 60% of the workers are highly skilled in the operation of IT technologies and almost 90% of the workforces are deemed knowledge workers. Workers at the three outlets are frequently sent to their Regional Head Quarters in Hyderabad where they undergo intensive training in IT technology. The investment in human capital in the form of training in the context IT

based software and hardware technology has indeed given the company the edge over other key players in the electronic industry.

Industry standards that evolve can be a major motivator for new innovation efforts by a business (Singer, 2005). The initiative often referred as 'Roadmap' set standards for firms competing in the industry on requirements and technology timelines within the industry. The road map required that manufacturers like the sample firm in the study meet some specific standards for the products they manufactured. These standards are updated periodically and a report is issued periodically.

The strategic difficulty for many firms especially in the electronic industry is that if they do not meet the stipulated standards, they could find themselves at a competitive disadvantage. This difficulty is compounded by the fact that the electronic components manufacturing industry moves very rapidly, and if a firm does not develop products or strategies that meet the standards internally, it may not be able to collaborate with or buy product lines externally from companies that allow them to meet those standards (Somekh, 2005).

The organization must be aware of what competencies or niche areas it possess. The resource –based view of the firm states that the principal means for a firm to gain a competitive advantage is through the skills and knowledge of its employees (Barney, 1991). The competencies of firm's employees cannot be easily duplicated by other businesses in the similar industry. This is in contrast to hard assets such as machinery because any firm that has the financial means can acquire similar assets.

In the light of the above the sample firm concerned perform a skills inventory to identify competencies that are present or needed. Such a skills inventory is simply a listing of the various training, understandings, certifications each employee has.

For example, e-business and e-commerce are domains that have come into prominence in recent years. The skills needed to manage in such an environment are different from the skills in more traditional business environments.

The last element of the extension category of implementation is identifying new opportunities. Often one innovation leads to a wide set of other or peripheral opportunities for the same technology (Geels, 2004). This process of technology transfer is known as sharing of information diffusion (Rogers, 1995). The amount of information diffusion in a firm greatly influences the innovativeness and rate of adoption in the organization.

4.6 Concluding Comments

The management of innovation does not necessarily need a radical shift service, and it can be as simple as a fresh insight how a particular technology can be used (Babyak, 2003). The management of innovation requires that the firm encourage creativity and risk taking by individuals. The firm must employ processes that allow failure and exploration (Frohman, 1998). The organization must make key decisions as it begins to examine technology and innovation and whether those processes are focused internally or externally. As far as the sample firm is concerned much of the technological possession is derived from both external and internal sources. However, the external sources are not entirely external but from its main headquarters in Toronto, Canada and its regional headquarters in Hyderabad, India. The rest of the technological innovations come from within their local branches in Malaysia, i.e. Kulim, Kedah and Senai and Johore Bahru in the state of Johore. The overall flow of technological transfer, both within and outside Malaysia among its member organizations varies and they cover different areas of operations. However, as per the objectives of the present study, the

technological innovation in this chapter is rather confined to innovations in the context of SCM operations only.

As has been mentioned in the previous chapters, the focus of the technological innovations utilise the ICT technology as a base. This is common among many modern industries across the globe. However, within the ICT framework, the sample firm has come up with many incremental innovations that are unique over the years, especially in the SCM process.

This technological innovations utilised in the SCM process is called IT-System Application Implementation (ITSAI). It is the effective use of ISAI and the effective management of this technology are the ones that permeates the effective practice in the SCM , which in turn contributes to the competitive advantage of the selected firm.
Knowledge of technological innovations get transferred very fast, especially among collaborative organizations. As a rule, if the so called technological innovations are strategic and central to competitive advantage to the organizations concerned, then, as an unwritten rule, they are likely to remain internal (Overby, 2003).

Discussions concerning the knowledge base of an organization tend to focus on R &D activities and other technical activities. However, an organization's ability to develop new technology that meet current market needs clearly involves more than a set of technical capabilities (Nelson,1991).The commonly held view of an organization's knowledge base comprising only technical matters is too narrow (Adler and Shenhar, 1990) and is made up of several dimensions.

The use and utilisation of ICT Innovative Software Solution For Information Sharing and Processing. These technological solutions in the SCM operations are practiced or applied in three phases as presented in the following table.

SCM Phases	Characteristics of technology Acquisition - ICT Innovative Software Solution for Information Sharing and Processing.	Innovation Move	Initiator	Lessons for others
1	Obtaining pricing information	BOM MATRIX	Celestica, Kulim	Obtaining pricing information via Technological Capabilities that saves time and eliminates human error.
2	Administration Comparing Quotations and Costing	ASPECT QUOTE-WIN	Celestica, Kulim	Information about drawings, changes, amendments or modifications made in manufacturing part numbers
3	Execution of Supply Chain via raising Purchase Order and delivery to meet production requirement.	SCMDW and SAP system	Celestica, Kulim	Creation of comprehensive inventory with specific code; savves time and helps in the minimum order quantity (MOQ) to safe cost.

Table 4.1 The key areas of concern include the amount of knowledge transfer required, the degree of integration needed, and the speed of integration necessary.

4.7 Triangulation

In the endeavour to crosscheck the results of his findings, the writer used methodological triangulation suggested in social research. According to Cohen and Manion, (2000) triangulation as an "attempt to map out, or explain more fully, the richness and complexity of human behaviour by studying it from more than one standpoint"(p.254), Triangulation is a powerful technique that facilitates validation of data through cross verification from more than one source (O'Donoghue and Punch, 2003).In particular, it refers to the application and combination of at least two research methodologies in the study of the same phenomenon (Altrichter et al., 2008). The idea is that one can be more confident with a result if different methods that may lead to the same result. By combining multiple methods, and empirical materials, varying the participants researchers can hope to overcome the weakness or intrinsic biases and the problems of single method studies (Denzin, 2006). In other words, this method is an appropriate strategy that could possibly eliminate the risk of credibility of qualitative analyses and hence can ensure reliability and validity. In the present study, the writer, chose to have further interview sessions with some of the representatives of the contracting parties in the pursuit of cross-checking the claims made by the SCM officials at the selected firm.

Although the interview statements given by the officers involved in the supply chain process at the selected firm were well-convincing and assuring, the writer wanted to verify them using another data source to avoid over dependability from a single source. Doing so might invoke the danger of 'interviewee bias (Cohen and Manion, 2000).

Using the clues given by officers concerned, the writer managed to locate a number of long-established customers who have been dealing business with the selected electronic firm. This endeavour was comparatively easier than affixing appointment with the

supply chain managers at the earlier phase. In this regard, to some extent the internet source was also helpful in tracing their location of the customers.

At this juncture it is important to inform the reader(s) that the selected firm plays the dual role of a supplier and a customer. It is a supplier of electronic motherboards or rather of a finished product to many other firms in the electronic industry, both in the Malaysian scenario as well as in the international arena. Likewise as a manufacturer of the said motherboards, it also buys numerous electronic components that make-up their finished product from various other suppliers. As such reader(s) is/are reminded that the new sample of 'customers' in fact, are comprised of both buyers and sellers.

After a number of serious attempts the writer managed to line up some interview sessions with the customers of the firm concerned. In the pursuit of striking a balance the writer identified three representatives each from both the 'buyer' and 'seller' categories. Unlike the earlier sample chosen for its technological capability, the new sample firms or rather their representatives did not mind the writer of revealing their identities. The highlights of the interviews are presented and conclusions are drawn in the following section accordingly.

4.8 Analysis and Interpretation of Interview data with the customers (the buyers and sellers category)

A number of pertinent questions were directed at some of the respondents in the buyers' category. At this juncture the readers are reminded that the selected electronic company under investigation is referred as "Company X" for hiding their identity. Most of the buyers are actually product manufacturers who wanted the electronic company to supply them component parts. When asked what the nature of their trade is and how long they (the buyer category) were dealing with the selected electronic company, which is the focus of our attention, one representative said:

"We are the original brand manufacturers producing servers, mobile phones and tablets under our own name . We have been in business for almost 20 years. For the past 10 years we had sourced out the assembly work to contractors like Company X and its competitors"

As the companies represent final manufacturers and the fact that they have been in business with the selected company gives us the notion that their business relationship with Company X is rather strong. When asked how they go about getting their supply of electronic components from Company X a respondent answered:

"Our R& D will request manufacturers via online catalogues, and some we work with manufacturers to build, that is to say made to order based on required specification."

In answering a question as how they could ensure the intended quality, he added:

"We obtain supply from various manufacturers around the world who produce component parts in accordance with world standards such as ISO, European Standard etc. We also buy from Company X as this company has very good network in terms of

sourcing the best and cheapest material just by clicking some buttons in their workstations."

Another respondent cum representative from the buyer category also claimed that they have had a lengthy duration of ten years' experience with Company X. The focus point of the view is that they appreciated the technological capabilities innovated by Company X . He said:

"We choose Company X just for their strength because they offer us online easy traceability of past records and current movement of products. Via the technological capability institutionalized by Company X, termed 'Production Pro' we can virtually know the production stage of the component part, and at which process stage of delivery and if there are any issues with it. Apart from that we buyers can also view our stock situation and know how fast it can be obtained via the software called 'WinwareLine'. The Company concerned also continuously upgrade their systems for facilitating easy communications."

Apart from facilitating supply, the innovative technological capabilities by Company X also renders its help in the operation and facilitation of various other managerial aspects among partner companies.

In responding to a pertinent question, what way(s) this company is doing a good job compared to other organizations in the supply of electronics components, one customer representative said:

"Well, we see tremendous improvement in our day to day operation of Inventory Management at our company. Now we run a very good inventory management without losses. All our inventory management is fully automated with fast tracking and speed obtaining capacity. We should thank Company X for their innovative technological

capabilities such as SCMDW applications for making our life easy and making our business more productive".

In adding to the above, another respondent reputed the technological innovations by Company X in the context of Materials Handling. He described the role of Company X's technological capabilities in the following order:

"All material handling procedures use a special form which enables the keying in system to reflect the required quantity. Every single requirement goes through a system called MATRIX before documentation and approval.., before any design by the party is permitted. As such this technological capability helps us in the handling and monitoring of materials with much flexibility and ease".

The most interesting and amazing fact obtained through the conversation with the supplier is that they were not prepared to start any new business relationships. That is to say they were not willing to start any fresh deal with other business concerns. When asked why they prefer Company X to the others, one respondent from the supplier category remarked:

"We are major customers for electronic manufacturing services industry as we do not assemble on our own; we prefer to have ties with Company X for a number of reasons. Firstly their good will, good customer service and competitive pricing. They manage to lower material and wastage cost by getting smaller MOQ and passing the cost over to suppliers. Managing material flow is the toughest part. However, assistance from many ICT based applications such as QUOTEWIN, ASPECT, SCMDW, EDI, and as system called 'Scavenger' they have had made the entire business operation possible with much ease and to the benefits of all the contracting parties."

Innovative business solutions on the part of Company X did not only enhance productivity and business success on its own right. The success of the company had also contributed to the counter success of partner companies in many aspects. When asked, how innovative ideas by Company X, especially in the context of technological innovations have helped the business by partner companies, one respondent answered:

"We had purchased some of the software applications that ensure our market entry at a greater speed (speed in response) as Company X has very good speed in terms of assembly, processing quotation and information for the purchase of material"

In the context of possible encounters on issues that could have caused problems, the customer and supplier representatives said so far their business relationship has been very good and nothing has ever occurred or caused resentment on either party. Having said this, one supplier representative recalled an important incident as how Company X's innovative technological capabilities came in handy during a critical situation. He said:

"Timely supplies are very crucial; basically the trust of our brand in the market comes from the pioneers who introduce new technology gadgets. Therefore when manufacturers produce new material, all the companies will have the same access of information. However, the question here is that who can get the gadget into the market first and be the pioneer. The system called 'Production Pro' used by the Company X can ensure product delivery in time. For example if a product were to have stuck or delayed for some reason, customers can know the exact position of the product and the reasons for the delay. You see, Company X has helped us in this aspect via their so called amazing technological capabilities".

In response to a question on events where Company X had let down the contracting parties, one customer said:

"So far no, even in some situation whereby the material became obsolete, Company X was able to obtain the specification of the parts; they know or can have a quick access to sources that can produce or reproduce what we wanted whilst meeting or sustaining the standard and other compliances such as ROHS. The application known as 'Scavenger' often assists Company X in this respect".

4.9 Concluding Comments

A lot of pertinent information was drawn from both the supplier and customer companies that have been dealing trade with Company X. The general consensus on the part of customer and supplier representatives is that Company X is a leading firm in the context of technology. The company concerned also urges other players in the industry to inherit technological innovative solutions. Above all the findings revealed a strong match between the data obtained from the Supply Chain managers at Company X and the views obtained from, the six members who represented the suppliers and customers. As such it is the contention of the writer that Company X is indeed an institution that is to be reckoned for its ICT base technological capabilities.

CHAPTER 5 STAGES OF IMPLEMENTATION OF TECHNOLOGICAL CAPABILITIES: (INNOVATIVE ICT SOFWARE SOLUTIONS FOR INFORMATION SHARING AND PROCESSING IN THE CONTEXT OF SUPPLY CHAIN MANAGEMENT)

5.0 Introduction

This special chapter discusses the developmental stages of technological capabilities by the selected firm. The first part of this chapter begins with a brief introduction on the economic and technological position of the selected firm. It then outlines some of the important features of technology and how the selected firm had initiated its innovative processes in the acquisition of technological capabilities. The second part discusses the ways by which the firm concerned incorporated its technological capabilities in the management of Supply Chain, and hence how it rewarded itself to be one of the front runners in the global electronic industry. In other words, this section captures some of the key drivers that underpin the success story of the technological innovations of the selected firm. The data for the section was derived from additional interviews held with some of the senior level officials at the three branch firms concerned. The chapter ends with views on challenges faced by the sample firm in their SCM operations.

Conversely, the officers interviewed at the three branches of the sample electronics firms were unable to relate the wholesome or holistic development of technology by the sample firm. In other words, they were only interested or concerned about sharing of the exploitation of technological capabilities in the context of their SCM operations but NOT the overall technological diffusion affecting the holistic development. Admittedly the officers concerned were unable to throw any light on the historical development of technological innovations. Moreover, the writer was told that it was

against the policy of the firm to disclose matters pertaining some of the intrinsic aspect of their operations. However, they were cooperative and did not mind revealing aspects that were pertinent in the management of their technological endeavours, but again only superficially. As such, an attempt is made in this section to address some of the basic issues of technological integration that fall within the jurisdiction of managerial contexts.

5.1 The Importance of Technology

The industrial world has seen a shift from labour and capital intensive industries to knowledge-and technology-based economies. According to Trott (2008) as competition has increased in markets throughout the world, technology has emerged as significant business factor and a primary commodity. Knowledge, transformed into know-how or technology, has become a major asset within companies. To put it in a nutshell, technology is vital for business to remain competitive in the modern world. In rapidly evolving markets, such as electronics as in the direction of the present study, new products and services based on new technology are indeed essential. Even in mature markets, new technology is necessary for firms to remain competitive on cost and quality (Trott, 2008).

The competitive edge of firms in today‘s turbulent global economy will increasingly depend on the quality and productivity of its human capital as well. Building human capacity must be based on clear and dynamic strategies that can effectively respond to the rapid changes taking place. In this regard companies must be capable, therefore, of adopting and adapting to new technologies. They have to continuously upgrade themselves, and stay ahead of change by learning and re- learning. They have to resort to making continuous retraining and skills upgrading as a pertinent business strategy in their pursuit of increasing product quality and market share. These efforts should focus

on not only the employees of the companies, but also the owners themselves. The owners should first set a good example in acquiring technological skills and knowledge before trying to motivate their employees to do the same.

5.2 The Underpinning Model(s) on Technological Development

As mentioned in the earlier chapters, the concepts that underpin the technological development of the firm, especially in the context of incorporation in the SCM process, come from three different areas, namely Porter (1998), Geel (2004) and Marcelle (2002). The results of the interview with the officers at the selected firm were matched with the number of existing models or concepts on technology transfer and technology diffusion. It was noted there was NO ONE model that fully matched the description given by the officers. However, in the writer's contention there were partial relevance and agreement in some areas.

Although, the concepts and models of technological innovations by Porter (1998) and Geel (2004) have already been cited in the chapter on Literature Review. The very purpose of this is to show how theories of technological innovations are realized or contradicted in the practical contexts.

5.3 Porter's (1998) Diamond Model

Porter claims that the success of companies no longer relates to their geographical advantages and availability and accessibility of factors of production. In short, Porter (1998) argues on the importance of effective use of technological innovations and management strategies as determinants of success in modern organizational settings. The technological innovations are to be seen in the context of industrial clusters that go hand in hand for mutual success.

Porter explains how clusters affect competition in three broad ways; first by increasing the productivity of companies based on the area; second, by driving the direction and pace of innovation; and third, by stimulating the formation of new businesses within the cluster. According to Porter, the clusters may also pose a paradox. For example, in theoretical grounds, location should no longer be a source of competitive advantage. Open global markets, rapid transportation and high-speed communication should allow any company to source anything from any place at any time. However, in practice, location remains central to competition.

As seen some of the points highlighted in Porter's (1998) diamond model especially the importance of technology as a competitive advantage was captured in the present study. Relevance also was seen in terms of industrial clusters of supportive and collaborative industries that worked hand in hand especially in the context od SCM practices of the selected firm.

5.4 Technological Transition and Diffusion in the Sample Firm

The sample firm chosen for the present study is a reputable multinational electronics manufacturing services (EMS) company headquartered in Toronto, Canada. The company's global manufacturing network comprises more than forty locations in eleven countries in the Americas, Europe and Asia, supplying a wide variety of leading OEMs (original equipment manufacturers). In addition to manufacturing, the company's global services include design and engineering, systems assembly, fulfillment and after-market services.

The firm's Toronto headquarters were originally the location of IBM's Toronto sales and support offices, which also supported a small manufacturing unit which built metal boxes for their mainframe computers and associated support systems. As the world

turned from mainframes to microcomputers, the company's operations were forced to diversify the plant's product lines, building circuit boards, memory products and power supplies that could be used in a wide variety of IBM products. The $300 million investment was successful, and by 1993 most IBM divisions were buying some of the systems produced in Toronto. The factory site expanded several time (Celestica, Inc, 2006).

At the beginning, the sample firm experienced a slow growth as many other international electronics firms around the world. It used only some very basic technology and there was no proper coordination of technology or knowledge management within the firm either. As a result the firm concerned suffered some setbacks in its business venture and operations. However, effective leadership and the managerial innovations coupled with unique technological capabilities had made it ascend gradually to become a profit making organization.

As IBM transitioned from a hardware company to software and services company, the future of the manufacturing unit was in doubt despite its financial successes. In 1992 , the management suggested that the entire division be spun off into a separate company that would offer their services to anyone. As a result the firm concerned was formed as a wholly owned subsidiary of IBM Canada. IBM's other divisions at the location moved to new buildings at various new locations, within and outside the Canadian territory.

A sustainable competitive advantage and the creation of value for a firm cannot possibly occur without attention to the development of capabilities (Trott,2008). Furthermore this focus on capabilities should be present in the firm from the very start. This start may be either entrepreneurial or intrapreneurial. The term intrapreneurial is used to describe entrepreneurial activities that occur within organizations. If the firms do not develop such capabilities at the very beginning and forced to develop them when they

are already facing fierce competition, then they are out of business while trying to recover from the absence of capabilities (Trott,2008).

5.5 How the selected firm has utilized the Internet technology in its SCM operations?

Naturally the internet has created tremendous values and it is natural to think about its power to connect systems, processes and companies to one another. That is how one should define a network such as the Internet. These are actually computer stems linked together in a way that makes it easier to disseminate and share information.

What is less obvious is the power of the internet to unlock value by separating different types of systems, business processes and companies, and give organizations the ability to use their resources most effectively. The internet has ushered in an area of connectivity based on open standards where people, devises and applications can communicate regardless of their location.

This very idea has been duly pointed out by Porter (1998) that location should no longer be a source of competitive advantage. This is to reiterate that open global markets, rapid transportation and high-speed communication should allow any company to source anything from any place at any time.

5.6 Geel's Model of Technological Innovation and Diffusion

Meanwhile, Geel (2006) talks about how firms have moved into various or multitude of peripheral technologies from one main technology. The multi-level perspective (MLP) was originally developed to understand transitions and regime shifts. In Geel's work, the basic ontology behind the multi-level perspective stems from sociology of technology, where three inter-related dimensions are important (a) socio-technical

systems, the tangible elements needed to fulfill societal functions; (b) social groups who maintain and refine the elements of socio-technical systems, and (c) rules (understood as regimes) that guide and orient activities of social groups.

Apparently , Geel's work aims to place emphasis and create a new agenda of innovation studies, i.e. the dynamics of **socio-technical transitions**. These transitions are a fundamental shift in entire systems and they come about through the interplay of technology, markets, business investment, public policy, cultural beliefs and consumer behavior.

Geel's work is **inter-disciplinary,** drawing upon a background in the philosophy of technology, and, Science and Technology Studies (STS). He has subsequently expanded in to Evolutionary Economics (EE) and Technology Innovation Management (TIM), and has been exploring management/business studies, neo-institutional theory and cultural studies.

The similarity being observed in Geel's theory in comparison with Porter's model is the flexibility of location and the effect of decoupling. The flexibility in location allows different types of functionality and expertise to be decoupled-separated from each other and relocated to make the most specialization. Just as water finds its own level when disparate sources are connected with pipes, functionality and expertise can flow to their ideal locations when systems, business processes and companies are connected over a ubiquitous network (Geel, 2004).

Decoupling allows organizations to benefit from scale as well as specialization, differentiation as well as vertical integration and centralization as well as decentralization. In the design of IT systems, the internet allows IT infrastructure to be

decoupled from end-user applications, so systems can be agile and responsive at the level of applications, yet robust and scalable in their infrastructure (Geel, 2004).

It lets companies decouple their back-office operations from customer-facing activities so that common services can be centralized while customer-facing activities can be moved closer to clients. By decoupling different activities in industry value chains, the internet enables companies to concentrate on their core skills while broadening their network partners.

5.7 The Technological Capability Building (TCB) Approach

Marcelle (2002) argues that to be effective in technological learning and capability building, developing firms must organise their learning and capability accumulation efforts as a systematic, organised process involving five critical components, including both management of internal processes and management of boundary relationships. It is further argued that proportional and simultaneous investment in all these five elements is likely to increase the stock of technological capabilities and to improve effectiveness of technological capability-building. In investigating the TCB process at the firm level, it is assumed that variations in TCB activity are likely to be influenced by developments that occur endogenously within the firm.

Technological capability (TC) is defined, in this paper as stated by Marcelle (2002) is the collection of firm-specific assets, both material and non-material, including equipment, skills, knowledge, aptitudes and attitudes that confer the ability to operate, understand, change and create production processes and products. In this definition of technological capability, there are aspects that are located in people, referred to as embodied elements of a technological capability, e.g., skills, attitudes, tacit knowledge, and aptitude, and other aspects that are non-embodied elements, e.g., codified

knowledge, equipment, and software. It is further specified that both of these broad types of capabilities are required for the optimal effect of a capability to be realised. The full specification of a TC also includes elements that coordinate the embodied and non-embodied aspects of TCs – organisational integration elements.

The organisational integration element of a TC is similar to the concept of organisational coherence and the concept of organisational congruence. At the detailed level, organisational integration is understood to include activities related to setting conditions for realising benefits from embodied and non-embodied capabilities, and management systems for decision-making, implementation and resource allocation, and establishment of a facilitating organisational culture. This framework builds on the resource-based approach to understanding capability development (Bell, 1984), which suggests that a capability is only meaningful because of the services it delivers to the firm. The framework developed here extends that treatment by delineating some of the human attributes that are required to confer meaning. According to Marcelle (2002) the three internal processes of the TCB system are:

Financing: allocating financial resources to technological capability-building effort. This involves mechanisms that identify and allocate financial resources to the TCB investment effort. This takes account of the investment characteristic of TCB.

Management practices: systems and decision-making rules that implement and support technological capability-building effort. This process includes a number of actions to manage the TCB process, to set rules and decision-making systems for undertaking TCB activities, and to provide coherence for the effort by linking the TCB activities to overall firm objectives. These actions provide organisational coherence for TCB activities, as well as make the intentions to invest in TCB operational.

Culture and Leadership: practices to establish and maintain an organisational culture in which technological capability-building effort is exercised with committed and skilled leadership. This process includes actions to provide legitimacy, psychological encouragement and motivation for the TCB effort. The culture and leadership aspect is not the preserve of the senior management team, but represents the actions taken to create an environment and culture in which staff at all levels perceive that they are free to undertake the complex, risky, problem-solving activities associated with TCB.

Relationships with suppliers: for accessing external TC resources there are mechanisms for accessing technological knowledge and artefacts from suppliers. For the majority of developing firms, importation of technological inputs from international firms is a major source of capability. The local innovation system in the majority of firms does not adequately provide sources of advanced technological knowledge, equipment, software and technical services. In this conceptual framework, this set of boundary relationships is defined as a technology acquisition process, in which developing country firms exercise constrained agency, but are not passive actors.

Relationship to the innovation system: used to access TC resources from the innovation system (national and global). This boundary relationship refers to relationships between firms and institutions in the innovation system. In this framework, the institutions within the domestic innovation system that are considered to be important sources of technological inputs include: knowledge-creating institutions such as universities, technical vocational colleges, training institutes and national centres; policy-making bodies; and authorities.

As Marcelle (2002) explains, the types of technological inputs that firms can derive from relationships with these institutions include: codified knowledge; tacit knowledge;

improved understanding of technological trends and patterns through regular interaction; information about sources of technological information and know-how; information on what TCB activities are permissible or feasible under existing legislative and regulatory rules; and information regarding changes in legislative and regulatory rules. These institutions can also be a source of embodied skills and know-how, to the extent that the local setting can provide skills and experience required by operating companies. The domestic innovation system institutions can also improve cost-efficiency in technological search activities, by providing common information services to all firms, and thus reducing the duplication of search costs.

According to Marcelle (2002), in evaluating the capability of a firm to enact these type of activities, four key resources need to be developed:

- Entrepreneurial resources: individual knowledge and experience in being innovative and managing new products and processes.
- Human resources: the makeup of the workforce for the firm, including the technical knowledge, level of training and development, and type of reward system
- External network resources: the existing linkages and potential linkages to outside resources for potential collaborative efforts
- Economic resources: profitability and marketability of the technology being developed.

Discussion:

This section of the chapter discusses the technological advancements and aspects that are related to technological development in the sample firm. As pointed out by Geel (2004) the technological transition and diffusion in many industry begins with one main core technology. Likewise in the context of the present study, especially in the endeavor

of SCM expansion, the firm concerned first started using the computer for its basic functions of record keeping and storage of data.

5.8 Technological Capability Building

In the light of Geel's (2004) model, under ordinary circumstances, the case of a simple personal computer is deemed powerful and yet user-friendly. In the absence of a network such as the Internet, all functionality, applications and data need to be located on the same personal computer. This involves a hidden compromise. If network such as the Internet is introduced into the picture, the situation changes dramatically. It is now possible to move the mainframe-like functions of the computer, such as storage and processing, to a central server that is powerful, reliable and scalable. At the same time it is now possible to allow PC –like functions, such as displaying information and taking user input, to stay close to the user.

If we cannot communicate effectively with partners and suppliers, the benefits of specialization are diluted because of the cost of coordinating activities across companies. With the Internet, companies no longer need to compromise between specialization and integration. By reducing the cost of interaction between companies and their partners, the Internet allows companies to limit their operations to what they do best, and to outsource non-core activities. The result: the disaggregation of industry value chains into networks of specialized companies called 'business webs' or 'value networks'. Again this concept is also 'visible' in Porter's (1998) argument on spreading industrial clusters.

5.9 Human Capital Development

In the light of the above, the sample firm in the present investigation has truly made tremendous investment in the context of recruiting high calibre IT personnel from the very start. The three branch firms get the technology personnel from their regional headquarters in Hyderabad, India located in the centre of the Silicone valley. In this regard the majority of the IT personnel are Indian expatriates who manage and guide the local IT personnel. According to the officers interviewed in the study, apparently this is the supreme strength of the organization. As IT skills are always subjected to improvements, the branches concerned send their IT personnel to Hyderabad for regular training.

In addition there is an extensive use of expatriate employees and consultants to expand the skills base available to the firms concerned. There is a great deal of reliance on recruitment of graduates from Technical colleges and universities as the main source of people-embodied technological capability. Besides in-house training programs also play an important role for continuous updating of skills, information and knowledge. Performance-related pay and benefits system were used extensively to encourage and motivate capability development for IT personnel and those engaged in operations pertaining SCM processes and activities.

5.10 Concluding Comments

The sample firm in the study has the experience, insight and ability to help companies involved in the SCM to achieve high performance, creating the ability to overcome its specific challenges. The firm has a track record in helping companies use technology to improve business performance. Their practitioners are experienced in bold, value-creating approaches to IT. They bring boardroom-relevant criteria to IT investments and help aspiring high-performance businesses to "think bigger" about its ability to improve operating results.

For companies wishing to begin or continue along the journey toward high performance, the sample firm has a unique mix of capabilities that make them the perfect partner. The benefits of partnership is explained under the following headings:

Deep Industry Insight: They have been working in this industry for years and have a track record of helping companies around the world enhance performance.

The Right People: They have an understanding of the capabilities necessary to be successful as well as the experience. As one of the world's largest management consultancy in the field of EMS, with a vast pool of business talent, the operators claim that nobody else can better help companies innovate intelligently to create competitive advantage.

Global Reach: The firm’s global presence means they can leverage local insight like nobody else. Partner companies can leverage the skill and cost benefits of global sourcing, adding scalability and flexibility to their business processes.

Technological Excellence: The capabilities enabling high performance are increasingly enabled by technology. From innovation to what works, they claim that nobody

understands how to use technology to better business advantage as they have the global capability to manage technology cost-effectively at higher service levels.

The sample firm, with its vast network of technological systems is committed to partnering with the various other firms in the SCM process, taking them on their journey toward high performance, helping to achieve their strategic goals in the most effective manner possible.

According to the Managing Director of the selected firm, they had a vision to embrace the challenge of building a worldwide company truly global in vision, leveraging each country's experience as they tend to optimize their resources and their technology. The success of the SCM operations in the sample firm is not completely free of challenges. As the hype around technology decreases, supplies are seeing clearly that technology's role is one of an enabler, speeding up of processes and delivering cost savings. In this respect, the SCM industry faces specific IT management challenges. In their view of the officers, suppliers and collaborative institutions need to transform their IT capabilities for a number of reasons. These include:

i) To aggregate and analyze customer data to enhance differentiation.

ii) To increase a company's ability to respond to a rapidly changing marketplace through enhanced flexibility and speed.

iii) To operate effectively, suppliers need to have one system working across stores (sometimes across national borders) to ensure the most effective use of stock and to support optimized business processes.

Transparency and Tracking: Suppliers need greater transparency between systems and better tracking to integrate systems from manufacturer through to consumer to obtain customer and sales information.

Customer Data: Information overload is a challenge for suppliers because they need to collect and sift through data to convert it into useful information in a customer-centric industry.

Global Data Synchronization: Enabled by radio frequency identification/electronic product coding, the entire supply chain is becoming more intelligent. This creates what the fir concerned calls ‘Silent Commerce’. Benefits for those concerned in the SCM process include enabling the use of real-time data to monitor inventory levels. Radio frequency identification tagging also positions the company to better safeguard its shipments by enabling the tracking of products from manufacturer through the supply chain.

However, the sample firm collaborates with companies to meet the need for positive IT management. The goal is to enhance business processes and keep up to date with innovation to become a high-performance business.

CHAPTER 6 CONCLUSION AND RECOMMENDATIONS

6.0 Summary of Findings

To recap this case study approach was carried out to seek empirical evidence on the impact of technological capabilities in enhancing the supply chain management in electronic manufacturing industries. As seen a well-known international electronics firm with its three branches, namely Kulim (Kedah), Senai and Johore Bahru (Johore) became the choice of investigation.

Qualitative interviews were conducted with selected personnel at the three outlets to collect data. A set of follow up interview sessions were conducted with selected representatives of partner firms that maintain customer-supplier relationships. The findings of the two different interviews were then matched to draw a comprehensive conclusion. It was noted that the description given by both of sample parties, i.e. SCM officials at Company X and representatives from its partner firms. The content analysis of the interviews revealed that, the success of the electronic firm was due to the efficiency in the supply chain management system. While many factors were perceived as important, the technological capabilities employed by the electronic firm concerned was regarded the backbone of the SCM activities and practice. This matched the evidence provided in the previous literature. A number of ICT solutions such as EDI, Quotewin, ASPECT etc were found to be highly effective and beneficial in the operation. These ICT based innovative software solutions reportedly been useful in detecting customer needs and demands. Likewise the same ICT solutions have been useful in accessing the SCM practices from which they get the raw material , intermediary or unfinished product supply. The effective coordination between these two supply chain management practices have made the selected electronic firm a successful business entity in this region.

SCM has become one of the new era manufacturing paradigms for organizational sustainability and competitiveness (Gunasekaran, 2004). One of the salient transformations in the rapidly evolving digital economy occurs in the supply chains of modern companies (Clark and Lee, 2000). As manufacturers attempt to increase supply chain performance, there is a critical need to gain a deeper understanding of impact of decisions on their operations as well as those of their partners. Simulation has been found to be one of the popular and suitable mechanisms for understanding supply chain dynamics. Many times supply chain re-engineering decisions are made with a probabilistic view of the future. As a result, there is a necessity for decision support tools that can help managers to understand the costs, benefits and risks associated with various alternatives.

In the light of the above this study discussed the nature of the supply chain, or rather technologically supported SCM that explored some of the attributes and capabilities. The attributes include internet-based collaboration, open leverage of capabilities within networks of companies and manufacturing, rather than outsourcing and market alliances. As SCM practices is becoming the decisive factor in competitive advantages, other key players in the industry should adopt similar strategies.

6.1 How The Objectives of The Study Are Achieved and Its Research Questions Answered?

This study was endeavoured to address FOUR (4) research questions. For the convenience of the reader(s) they are presented in the form of questions and answers.

1. What are the strategic factors in SCM operations that determined the success of the selected Electronic Firms?

   The strategic factors identified in SCM operations of the selected electronic firm branches are : the use of ICT based innovative solutions that exploits the internet technology for expediting communication between and among contracting parties. One of the key areas for business progress and success, especially in the electronic industry is attributed to effective communication. As the life-line of the SCM operation lies in the effective handling of communication procedures, this area becomes the crucial concern for the management of the selected electronic firm.

   Moreover, considering the setbacks caused by human errors due to communication problems suffered in the past, the selected firm had resorted to ICT based technological measures that had in fact minimised the constraints on time and subsequent cost factors.

   As such, using their very own, and sometimes using aspects of transferred technology, the selected firm had come with ICT based technological tools for the effective implementation of SCM practices. These ICT or internet based technological solutions have brought tremendous progress in the SCM operations to date and thereby ultimately enhancing the overall success of the firm.

   The research question on this was answered or rather achieved via the perspectives of officials (qualitative interviews) involved in the SCM process.

2. What ‘Technological Capabilities’ (ICT based innovative software solutions for information sharing and processing) are adopted by the selected Electronic Firms in the Malaysian context?

   As has been pointed out in the literature via models of Porter and Geels in the literature review, technology is an integral component that determined the success of modern day businesses. Although the use of technology cuts across every area of business, in the scope of this study they are focussed on ICT and internet based solutions in the context of SCM operations. Via the perspectives of the SCM officials at the branch offices of the selected sample, it was noted that software programs such as Quote-Win, Interface etc. have contributed to the success of the firms.

3. How the above stated ‘Technological Capabilities’ (i.e. ICT based innovative software solutions for information sharing and processing) are attributed to Supply Chain Management process and how they contribute to the success of the selected Electronic Firms?

   Nowadays, competition among businesses is centered around SCM practices. In other words, it is not that businesses compete with one another. but the effective practices in the SCM processes and operations that has given firms the competitive advantage over their business rivals.

   Via the perspectives of the officials interviewed at the selected sample firm, it was noted that, much of the cost or rather monetary loss was attributed to the problems faced in the SCM sector. For example delays due to communication and human errors, resulted in the incurring of unnecessary costs in the past. The ICT based technological tools has brought about a sharp decline in the amount of cost incurred. As there is a considerable cut down on delays and cost factors, the selected firm has

been achieving profit maximization and it is on the road to success deemed exemplary for other firms in the industry.

4. How the ICT based Technological Capabilities at the sample firms help promote business gains among their partner firms, in the context of mutual supplier-customer relationships?

   It was learnt from the perspectives of the representatives of the partner firms that, the ICT based technological solutions employed in the SCM operations of the selected firm have infact helped to achieve mutual gains for contracting parties. As communication is a two way process, the parameters achieved in this respect had in fact led to monetary gains and profit maximization among collaborating parties.

   As per the comments of the representatives of the contracting firms, there seemed unwanted delays due to miscommunication and human errors. As for now, much of their grievances have been resolved due to the employment of sophisticated ICT based innovative solutions on the part of the selected firm.

6.2 Limitations

This study touches on the importance of technological capabilities in the SCM processes, in the context of an electronic firm. The respondents in this 'case study' only highlighted the advantages of the technological aspects in the SCM process and made no mention of the disadvantages. Due to time constrains, and security reasons, the respondents were admittedly reluctant to disclose some of the operational processes to the writer. The writer was told that it was against the policy of the firm to disclose matters pertaining some of the intrinsic aspects of their firm's operations. As such this study is a simple and brief description or a bird's eye view of the use of technological aspects in the SCM operations and processes in an electronic manufacturing firm. Nevertheless, this study used a case-study –like approach which managed to but only

highlight some of the intrinsic aspects of the ICT usage in the SCM practices in the selected firm. It is learnt that collaborative practices are constantly evolving within and between network companies. A number of drivers have been identified as the underpinning elements behind the successful operations of SCM practices that in turn contribute to the overall success of the firm as an industry leader. They include aspects such as industrial culture, size of the companies, strategic locations etc. However, as per the findings of this study and many other literature in this arena have taken note of the role of ICT in SCM operations.

It is important to mention that despite the above theoretical and practical contributions, some limitations are discernible. First the number and quality of interviewed persons could be extended to cover all staff levels of the organization concerned. Data should be collected on their personal characteristics as technological capabilities are not stand-alone entities and they are subjected to the effective use and of managerial practices. As such data should extend to age, training, previous experiences and position in the organization.

6.3 Recommendations

It is recommended that future studies on technological capabilities should cover other industries possibly in terms of more case to case basis. Likewise the studies must also cut across other managerial aspects such as operation management, risk management and innovation management. Inter disciplinary studies that might incorporate other managerial and leadership aspects pertaining technological capabilities such as organization conflicts, policy matters etc. both within and across the globe may also contribute new knowledge in SCM operations.

LIST OF APPENDIXES

Appendix A: Semi-Structured Interview Questions

Question 1 : Why Technological Capabilities in SCM is Very Important for Companies like yours ?

Question 2 : Why Technological Capabilities in SCM Has Become The Major Effort of your company Comparatively to Other Sites Such as in Singapore?

Question 3 : Why Your Do Not Concentrate of Pricing Negotiation to Reduce Their Operating Cost ?

Question 4 : What are the Areas of Focus in Developing These Capabilities ?

Question 5 : What are the Types of Technological Capabilities that Your Company has Currently?

Question 6 : Is there any documented Process of Your Company Supplier Selection and Why it is Important ?

Question 7 : How About Your Company's Partnerships Programme With Supplier and Why it is Important ?

Question 8 : Can You Explain on Your Company's Collaboration Activities Among Supplier and Why it is Important ?

Question 9 : Can You Explain on Your Company's Purchaser-Supplier Interface And Why it is Important ?

Question 10 : Can You Explain on The Types Of Supplier Integration And Why it is Important ?

Question 11 : Can You Explain on Effort In Building Trust And Why it is Important ?

Question 12 : Can You Explain on Managerial Capabilities And Why it is Important ?

Question 13 : What is IPC? How It Helps Your Company's in Lowering Their Cost Apart From Pricing Factor?

Question 14 : Why IT Plays An Important Role in Developing Technological Capabilities In SCM?

Question 15 : How Decision Making Process Assisted in Developing these IT Tools ?

Question 16 : How Your Company Develop These Capabilities Over the Time ?

Question 17 : Is It True That Capabilities Developed are then Transferred to Sites Globally ?

Question 18 : From Your Experience , How Do You Find the Capabilities Contribution Towards Company's Growth ?

Question 19 : How is the Management Support Towards this Effort ?

Question 20 : What Will be the Future Direction of Technological Capabilities in SCM?

Appendix B: List of Company's Branches

List of Company's Branches

Country	Location
Canada	Ottawa Toronto
Mexico	Monterrey Reynosa
USA	Arden Hills Austin Dallas Fontana Manchester Nashville San Jose
Czech Republic	Kladno Rajecko
Ireland	Galway
Romania	Oradea
Spain	Valencia
Switzerland	Zurich
China:	Dongguan Shatin Hong Kong Shanghai Song Shan Lake

	Suzhou
Japan	Kawasaki Miyagi Tokyo
Korea	Seoul
Malaysia	Johor Bahru Kulim Senai
Singapore	Woodlands Serangoon
Taiwan	Taipei
Thailand	Laem Chabang

Appendix C: Major Accomplishment by The Company

Hewlett-Packard has selected the studied company to be the overall primary manufacturer in Europe for its inkjet printers. The studied company would supply printed circuit board assemblies and complete box assembly for the printers, which would be manufactured at the company's industrial park in Hungary.

In April 2004, the studied company entered into a service partnership with Corio Inc., an application service provider. Under the agreement, the studied company would host and maintain application software on its servers, while Corio would implement the software for their joint clients. This would enable the clients to rent, rather than purchase, expensive enterprise resource planning (ERP) systems and help them to meet capacity demands without utilizing major investments which could be deployed elsewhere.

In April 2004, the studied company strengthened its relationship with Compaq when it won a new order contract to supply Compaq with printed circuit board assemblies for PC servers as well.

The studied company has also joined with Cadence Design Systems Inc. and Hewlett-Packard Co. to establish Spin Circuit Inc., an e-commerce company. Spin Circuit Inc. was an Internet gateway that would link printed circuit board (PCB) design engineers directly to suppliers of more than two million parts through its online catalog. Spin Circuit Inc. was intended to cut costs associated with PCB development and the selection of electronic components. Later in the year the studied company and Cisco Systems also partnered to integrate their supply chains via the Internet.

(Source: Website of the the studied company)

(Source : 2009 Annual Business Release)

The Studied Company Customer Loyalty Scores

Figure above shows the increase in customer loyalty in percentage. The percentage increases from 67% to 79% in a year duration of technological capabilities focus.

Appendix D: Examples of TCOO

Examples of TCOO

(i) MOQ

FACTOR	Supplier A	Supplier B	Supplier C
Unit Price (USD)	1	2	3
MOQ	300	100	50
Total Impact	300.00	200.00	150.00

Above table is an example of how a MOQ TCOO mechanism works.

By looking at the total impact (financial cost), supplier C will the best choice although the price is higher comparatively then supplier A & B. The higher the MOQ will have contribute higher the financial impact to CH. Purchasing a small requirement material especially with higher MOQ will lead to financial loses, extra insurance cost and extra storage cost.

Thus, the new mechanism of supply chain activity highlights the importance of other factors beside unit cost and able to eliminate hidden cost associated.

(ii) Lead Time

Factor	Supplier A	Supplier B	Supplier C
Unit Price (USD)	1	2	3
Lead Time	10	3	15

Above table is an example of how a Lead Time TCOO mechanism works.

Considering the lead time (number of weeks taken to deliver) supplier B will the best choice although the price is higher comparatively then supplier C and supplier A.

If a part's lead time is long then the studied company would have to purchase that part and store it in the warehouse which will incur carrying cost (cost of losses, insurance & space). It is not feasible to have long lead time for material especially during sudden orders from customers. Failing to meet customer expectation for sudden orders and faster turn around time in delivery is a serious omission in manufacturing. Successful organization such as CH would not prefer any long lead time supplier that is eliminated by this capability. This new approach highlights and stresses a company's supply chain activity should not only look into the pricing factor only.

(iii) Payment Term

Factor	Supplier A	Supplier B	Supplier C
Unit Price (USD)	1	2	3
Payment Term (Days)	45	90	45

Above table is an example of how a Payment Term TCOO mechanism works.

Considering the Payment Term (number of days taken to pay) supplier B will the best choice although the price is higher comparatively then supplier C and supplier A. If a supplier payment term is shorter then the studied company would have to be prepared a faster cash flow that will incur cost (interest).The longer the payment term that CH has the better it is. In some instances CH are able to purchase material from these suppliers , assemble and deliver to its customer before making any payment to its material supplier. Therefore CH is running the operation without any initial investment on material.

Factor	Supplier A	Supplier B	Supplier C
Unit Price (USD)	1	2	3
MOQ	300	100	50
Total Impact	300.00	200.00	150.00

Factor	Supplier A	Supplier B	Supplier C
Unit Price (USD)	1	2	3

Lead Time	10	3	15

Factor	**Supplier A**	**Supplier B**	**Supplier C**
Unit Price (USD)	1	2	3
Payment Term (Days)	45	120	45

Above table is an example of how a Payment Term TCOO mechanism works.

Considering the all the TCOO factors supplier B will the best choice although the price is higher comparatively then supplier A and supplier C. The cost for supplier B increased 100% compared to supplier A however the payment term increased by 167%.

So this new paradigm has contributed in the studied company group financial results, increasing trend of cash balance reflects to us that a company's supply chain activity should not only look into the pricing factor only, meet other factor which will also incur cost that most of the companies do not consider. In conclusion, the best supplier will have the lowest price, shortest lead-time and the longest payment term.

Appendix E: Press Release

Press Release

The studied company **Recognizes E2open With Its 2007 Total Cost of Ownership Supplier Award**

Article from; PR Newswire Article Date: June 12, 2008

REDWOOD CITY, Calif., June 12 /PRNewswire/ -- E2open today announced it has been awarded the Innovative Award in the 2007 Total Cost of Ownership (TCOOTM) Supplier Awards program from the studied company, a global leader in the delivery of end-to-end product lifecycle solutions. This award recognizes suppliers that support the studied company's overall supply chain goal -- to reduce the total cost of ownership for its customers and give them the flexibility they need to overcome any challenge. "E2open is proud to be recognized by the studied company," said Andrew Salzman, chief marketing officer, E2open. "E2open's multi-enterprise value network solution provides a working business model that helps companies achieve visibility and performance improvements with global suppliers across multiple tiers. Synchronizing supply and demand and procure-to-pay processes across the end-to-end value chain network is a critical business imperative driving increased productivity and collaboration for today's forward thinking value chain leaders."

This marks the second year of the studied company's TCOO Supplier Awards program. The program aligns with the studied company's Ring strategy, which focuses on shortening lead times through enhanced supplier proximity, as well as its TCOO supply chain strategy, which enables customers to deliver high-quality products to market quickly and at the lowest total cost. the studied company 's TCOO system is designed to

calculate the true cost to produce, deliver and support products and services beyond the supplier invoice price. As such, it considers the following supplier attributes: quality, delivery, technology, service, pricing and flexibility.

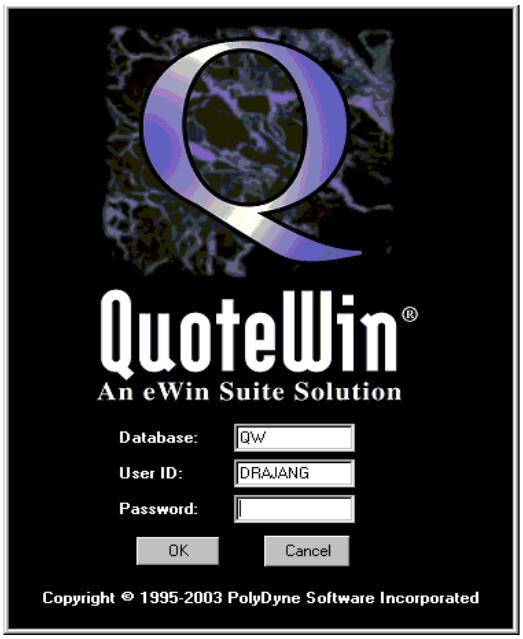
"Congratulations to E2open for being recognized with a 2007 TCOO Supplier Award," said John Boucher, Executive Vice President, Supply Chain Management Solutions and Chief Procurement Officer, the studied company. "I sincerely thank E2open for supporting our supply chain strategy and helping us to drive speed and responsiveness in the supply chain"

Further information can be found at:

http://www.google.com.my/search?hl=en&q=Celestica+Recognizes+E2open+With+Its+2007+Total+Cost+of+Ownership+Supplier+Award&btnG=Google+Search&meta=&aq=f&oq=

Appendix F: ASPECT Application is one of CH's SCM Technologies

ASPECT application is one of CH's SCM technologies for material reference. Using this material database technology, SCM analyst would be able to send a quote request to supplier using automated technology via internet known as Quotewin.



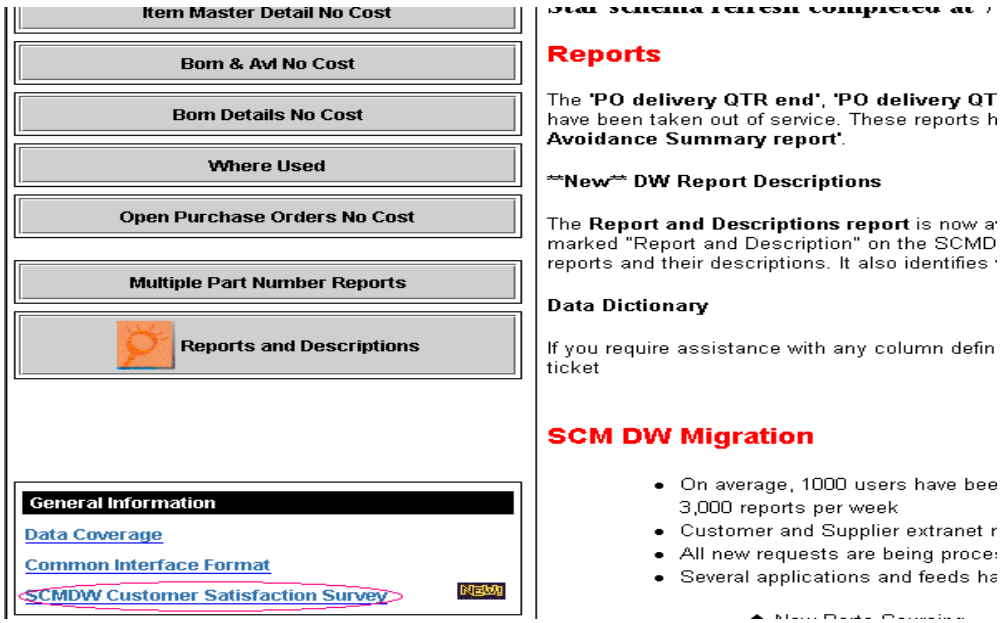
The Studied Company QuoteWin Systems

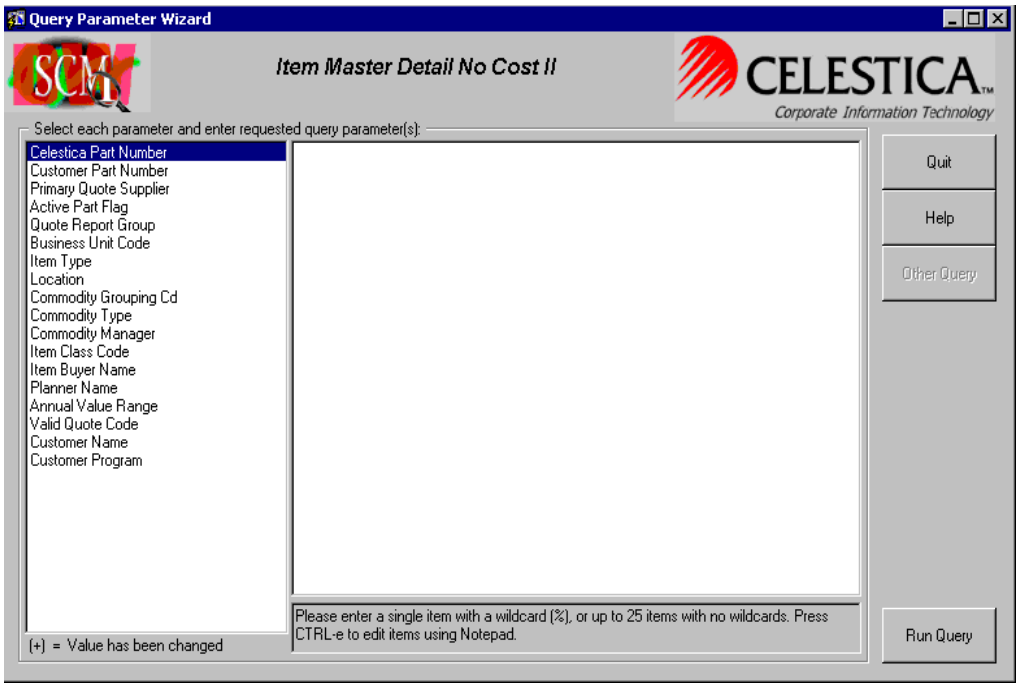
Quotewin enables the studied company to send a quote request to suppliers which will automatically send a quote request to supplier email address stored, prompting that there is a request that require supplier action to log in the studied company web quoting website with their own ID and password given by the studied company for quoting purposes. Not only that, the material required to quote, which has the lowest inventory count or there are future demand by timeline is also automatically prompt from production line to SCM team by a another technology called 'supply chain management data warehouse'

The Studied Company Supply Chain Management Data Warehouse

Supply Chain Management Data warehouse is another technology that enables CH to generate report on material that required to purchase. It is also an indicator of the material inventory count, material on demand, program manager, buyer, plant and many more information on a particular material.

There are also technologies that CH has on customer satisfaction survey for each manufacturing project undertaken. This allow customer to be able to challenge pricing of each material quotation obtain using Quotewin by this online reporting & feedback form.





This customer reporting form enables customer to view on the progress of the project in detail and feedback to CH on issues, proposal and solution immediately. There are few fields on view such as by CH part number for the material, planner name, commodity type, primary supplier and many more technological factors that CH uses in communication with its customer. A well-developed understanding of the relationship

between supply chain processes and execution management is part of this skill set as well.

Appendix G: Decision Support Model (DSS), Best Value Procurement Options

In designing a tool, IT requirements are the inputs for the DSS model while a ranked list of best value procurement options are the output of the model. The model uses below list of criteria for consideration to identify the best-value IT tool development that able to solve problem or bring improvement to CH's IT technological capabilities.

IT category	**IT solutions**	**IT procurement requirements**	**Ranked list of best value IT procurement options**
Hardware	Standalone computers	Cost, Time, Payment options, After sales, Maintenance, Quality, User friendliness, Reputation, Flexibility, Complementary	Off the shelf supply contracts: 1) Calling quotation 2) Through nomination 3) Direct purchasing
	Simple Local Area Network (LAN)	Same	Supply and installation contracts: 1) Calling quotation 2) Open tendering 3) Through nomination
	Complete Local Area Network (LAN)	Same	Supply and installation contracts: 1) Open tendering 2) Calling quotation 3) Through nomination
Software	Licensed Standard Software	Cost, Time, Payment options, After sales, Maintenance, Training users, Quality, User friendliness, Reputation, Flexibility,	Off the shelf supply contracts: 1) Through Agents 2) Through original manufactures

	Business Function Application Software	Same	Off the shelf supply contracts: 1) Open tendering 2) Bespoke development 3) Through agents 4) Original manufacturer 5) Calling quotation 6) Through nomination
	Construction Specific Application Software	Cost, Time, Payment options, After sales services, Maintenance, Training users, Quality, User friendliness, Reputation, Flexibility, Complementary	Off the shelf supply contracts: 1) Bespoke development 2) Open tendering 3) Through agents 4) Original manufacturer 5) Calling quotation 6) Through nomination
	Web design	Same	Supply and installation contracts: 1) Calling quotation 2) Open tendering 3) Through nomination
Human resource	Unskilled	Experience, Educational qualifications, Professional qualifications, Time, personality	Through nomination 1) Through Agents 2) Paper advertisement
	Skilled	Same	Paper advertisement 1) Through Agents 2) Through nomination
	Professional	Same	Paper advertisement 1) Through Agents 2) Through nomination
IT Services	IT strategy consulting	Cost, Time, Payment options, Quality, Reputation, Flexibility Complementary	Pure consultancy contracts; 1) Calling quotation 2) Open tendering 3) Through nomination

	Training	Same	Off the shelf supply contracts: 1) Calling quotations 2) Through Agents 3) Open tendering 4) Through nomination
	Backup, Disaster recovery/ IT security	Cost, Time, Payment options, After sales, Maintenance, Training users, Quality, User friendliness, Reputation, Flexibility, Complementary	System supply contracts: 1) Open tendering 2) Calling quotations 3) Through nomination
	Maintenance and service of equipments	Same	Off the shelf supply contracts: 1) Open tendering 2) Calling quotations 3) Through nomination

Benefits accrued from CH's IT tools is as below:

- Single point of accountability reduces IT complexity and management costs
- Ubiquitous access ensures 100 percent supplier participation-lowering costs and reducing administrative effort.
- Real-time data exchange reduces information latency empowering better responsiveness to dynamic business environments
- Automated self-testing lowers IT costs and speeds business process adoption
- Reduce item setup and maintenance time and decrease administrative costs.
- Reduce invoice discrepancies – saving time and money reconciling mismatched invoices.
- Improve time- to- market with streamlined and automated item, price and promotion management.
- Reduce stock-outs caused by poorly managed item and case configuration changes.
- Single solution provider reduces project risk and improves speed of adoption, reducing times to ROI.

Appendix H: Sample of Quotation

Universal Air Filter Company
1624 Sauget Industrial Parkway
P.O. Box 5006
Sauget IL 62206

Phone 618-271-7300
Fax 618-271-8808

www.uaf.com

UL Registered Firm
Registered to ISO 9001
Certificate No. A3076

Quote No. 11291

December 28, 2004

DEVENDRAN RAJANGAM
CELESTICA MALAYSIA SDN.BHD.
PLOT 15 JALAN HI-TECH 2/3 PHASE 1
09000 KULIM, KEDAH NAKATSUA
KULIM HIT-TECH PARK
MALAYSIA

Phone
Fax

Dear DEVENDRAN:

Line	*Part No.*	*Part Description*
1	BKTPL-0000000005 *Rev* A02	FF-3 AIR FILTER 6.45" x 7.85" x 0.30" with black 45 PPI Quadrafoam rated UL 94 HF-1. Aluminum frame and Uni-grid support on one side. Filter frame flange trimmed to .25" around perimeter on both sides. Filter complete with part number, rev level and date code stamped into frame. Slotted polytab installed on one frame edge and steel spring clip on opposite edge.

Lead Time 3 WEEKS

Quantity	*UM*	*Unit Price*
100	EA	16.97
250	EA	15.95
500	EA	14.92
1000	EA	14.66
2000	EA	14.32

40 pieces, $19.47 each, setup charge included.

Leadtime - 3 weeks
Contract Pricing - NO

Salesperson BARBARA BORAWSKI
uaf@uaf.com

An additional $100.00 setup charge applies for all orders/shipments less than 100 pieces per part/shipment. Minimum order is $200.00 per part/shipment.

Tolerances:
(Framed Filters) +/- .06" length & width, +/- .03" thickness.
(Pad Filters) +/- .12" length & width, +/- .06" thickness.

1. Prices are F.O.B. Sauget, Illinois
2. The above delivery schedule is subject to previous commitments of UNIVERSAL AIR FILTER COMPANY.
3. This quotation is subject to acceptance, in writing, within 90 days from the date hereof, and if not accepted shall become null and void at the expiration of said 90 day period.
4. All previous quotations on items quoted herein are hereby cancelled.
5. All purchases of the above must be confirmed in writing.
6. UNIVERSAL AIR FILTER COMPANY shall not be responsible for any delays in production or delivery due to strikes, fires, or other causes beyond our control.
7. All prices are subject to increase to compensate for any tax, excise, or levy imposed upon the goods sold, or upon the manufacture, sale or delivery thereof, or whenever any tax, excise, levy, law or government regulation shall have the effect directly or indirectly of increasing the cost of manufacture, sale or delivery of such goods.

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